

## 780 CMR 58.00

### ROOF-CEILING CONSTRUCTION

#### 780 CMR 5801 GENERAL

**5801.1 Application.** The provisions of 780 CMR 56.00 shall control the design and construction of the roof-ceiling system for all *one- and two-family detached dwellings and accessory* buildings.

**5801.2 Requirements.** Roof and ceiling construction shall be capable of accommodating all loads imposed according to 780 CMR 5301 and of transmitting the resulting loads to the supporting structural elements.

**5801.3 Roof Drainage.** In areas where expansive or collapsible soils are known to exist, all dwellings shall have a controlled method of water disposal from roofs that will collect and discharge all roof drainage to the ground surface at least five feet (1524 mm) from foundation walls or to an approved drainage system.

#### 780 CMR 5802 WOOD ROOF FRAMING

**5802.1 Identification.** Load-bearing dimension lumber for rafters, trusses and ceiling joists shall be identified by a grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20.

In lieu of a grade mark, a certificate of inspection issued by a lumber grading or inspection agency meeting the requirements of 780 CMR 5802 shall be accepted.

**5802.1.1 Blocking.** Blocking shall be a minimum of utility grade lumber.

**5802.1.2 End-jointed Lumber.** Approved end-jointed lumber identified by a grade mark conforming to 780 CMR 5802.1 may be used interchangeably with solid-sawn members of the same species and grade.

**5802.1.3 Fire-retardant-treated Wood.** Fire-retardant-treated wood (*FRTW*) is any wood product which, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84, a listed flame spread index of 25 or less and show no evidence of significant progressive combustion when the test is continued for an additional 20-minute period. In addition, the flame front shall not progress more than 10.5 feet (3200 mm) beyond

the center line of the burners at any time during the test.

**5802.1.3.1 Labeling.** Fire-retardant-treated lumber and wood structural panels shall be labeled. The label shall contain:

1. The identification mark of an approved agency.
2. Identification of the treating manufacturer.
3. The name of the fire-retardant treatment.
4. The species of wood treated.
5. Flame spread and smoke developed rating.
6. Method drying after treatment.
7. Conformance with appropriate standards in accordance with 780 CMR 5802.1.3.2 through 5802.1.3.5.
8. For FRTW exposed to weather, damp or wet location, the words “No increase in the listed classification when subjected to the Standard Rain Test” (ASTM D2898).

**5802.1.3.2 Strength Adjustments.** Design values for untreated lumber and wood structural panels as specified in 780 CMR 5802.1, shall be adjusted for fire retardant-treated wood. Adjustments to design values shall be based upon an approved method of investigation which takes into consideration the effects of the anticipated temperature and humidity to which the fire-retardant-treated wood will be subjected, the type of treatment and redrying procedures.

##### **5802.1.3.2.1 Wood Structural Panels.**

The effect of treatment and the method of redrying after treatment, and exposure to high temperatures and high humidities on the flexure properties of fire-retardant-treated softwood plywood shall be determined in accordance with ASTM D 5516. The test data developed by ASTM D 5516 shall be used to develop adjustment factors, maximum loads and spans, or both for untreated plywood design values in accordance with ASTM D 6305. Each manufacturer shall publish the allowable maximum loads and spans for service as floor and roof sheathing for their treatment.

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**5802.1.3.2.2 Lumber.** For each species of wood treated the effect of the treatment and the method of redrying after treatment and exposure to high temperatures and high humidities on the allowable design properties of fire-retardant-treated lumber shall be determined in accordance with ASTM D 5664. The test data developed by ASTM D 5664 shall be used to develop modification factors for use at or near room temperature and at elevated temperatures and humidity in accordance with an approved method of investigation.

Each manufacturer shall publish the modification factors for service at temperatures of not less than 80°F (26.7°C) and for roof framing. The roof framing modification factors shall take into consideration the climatological location.

**5802.1.3.3 Exposure to Weather.** Where fire-retardant-treated wood is exposed to weather, or damp or wet locations, it shall be identified as “Exterior” to indicate there is no increase in the listed flamespread index as defined in 780 CMR 5802.1.3 when subjected to ASTM D 2898.

**5802.1.3.4 Interior Applications.** Interior fire-retardant-treated wood shall have a moisture content of not over 28% when tested in accordance with ASTM D 3201 procedures at 92% relative humidity. Interior fire-retardant-treated wood shall be tested in accordance with 780 CMR 5802.1.3.2.1 or 5802.1.3.2.2. Interior fire-retardant-treated wood designated as Type A shall be tested in accordance with the provisions of 780 CMR 5802.

**5802.1.3.5 Moisture Content.** Fire-retardant-treated wood shall be dried to a moisture content of 19% or less for lumber and 15% or less for wood structural panels before use. For wood kiln dried after treatment (KDAT) the kiln temperatures shall not exceed those used in kiln drying the lumber and plywood submitted for the tests described in 780 CMR 5802.1.3.2.1 for plywood and 5802.1.3.2.2 for lumber.

**5802.1.4 Structural Glued Laminated Timbers.** Glued laminated timbers shall be manufactured and identified as required in AITC A190.1 and ASTM D3737.

**5802.2 Design and Construction.** Roof-ceilings shall be designed and constructed in accordance with the provisions of 780 CMR 56.00 and 780 CMR Figure 5606.10(1) or in accordance with

AFPA/NDS. Components of roof-ceilings shall be fastened in accordance with 780 CMR Table 5602.3(1).

**5802.3 Framing Details.** Rafters shall be framed to ridge board or to each other with a gusset plate as a tie. Ridge board shall be at least one-inch (25.4 mm) nominal thickness and not less in depth than the cut end of the rafter. At all valleys and hips there shall be a valley or hip rafter not less than two-inch (51 mm) nominal thickness and not less in depth than the cut end of the rafter. Hip and valley rafters shall be supported at the ridge by a brace to a bearing partition or be designed to carry and distribute the specific load at that point. Where the roof pitch is less than three units vertical in 12 units horizontal (25% slope), structural members that support rafters and ceiling joists, such as ridge beams, hips and valleys, shall be designed as beams.

**5802.3.1 Ceiling Joist and Rafter Connections.** Ceiling joists and rafters shall be nailed to each other in accordance with 780 CMR Tables 5602.3(1) and 5802.5.1(9), and the assembly shall be nailed to the top wall plate in accordance with 780 CMR Table 5602.3(1). Ceiling joists shall be continuous or securely joined where they meet over interior partitions and nailed to adjacent rafters to provide a continuous tie across the building when such joists are parallel to the rafters.

Where ceiling joists are not parallel to rafters, subflooring or metal straps attached to the ends of the rafters shall be installed in a manner to provide a continuous tie across the building, or rafters shall be tied to one-inch by four-inch (25.4 mm by 102 mm) (nominal) minimum-size crossties. The connections shall be in accordance with 780 CMR Table 5602.3(1) or connections of equivalent capacities shall be provided. Where ceiling joists or rafter ties are not provided at the top plate, the ridge formed by these rafters shall also be supported by a girder designed in accordance with accepted engineering practice.

Rafter ties shall be spaced not more than four feet (1219 mm) on center.

**5802.3.2 Ceiling Joists Lapped.** Ends of ceiling joists shall be lapped a minimum of three inches (76 mm) or butted over bearing partitions or beams and toenailed to the bearing member. When ceiling joists are used to provide resistance to rafter thrust, lapped joists shall be nailed together in accordance with 780 CMR Table 5602.3(1) and butted joists shall be tied together in a manner to resist such thrust.

**5802.4 Allowable Ceiling Joist Spans.** Spans for ceiling joists shall be in accordance with

780 CMR Tables 5802.4(1) and 5802.4(2). For other grades and species and for other loading conditions, refer to the AF&PA Span Tables for Joists and Rafters, or the AF&PA Maximum Span Calculator for Joists and Rafters.

**5802.5 Allowable Rafter Spans.** Spans for rafters shall be in accordance with 780 CMR

**5802.5.1 Purlins.** Purlins are permitted to be installed to reduce the span of rafters as shown in 780 CMR Figure 5802.5.1. Purlins shall be sized no less than the required size of the rafters that they support. Purlins shall be continuous and shall be supported by two-inch by four-inch (51 mm by 102 mm) braces installed to bearing walls at a slope not less than 45 degrees from the horizontal. The braces shall be spaced not more than four feet (1219 mm) on center and the unbraced length of braces shall not exceed eight feet (2438 mm).

**5802.6 Bearing.** The ends of each rafter or ceiling joist shall have not less than 1½ inches (38 mm) of bearing on wood or metal and not less than three inches (76 mm) on masonry or concrete.

**5802.6.1 Finished Ceiling Material.** If the finished ceiling material is installed on the ceiling prior to the attachment of the ceiling to the walls, such as in construction at a factory, a compression strip of the same thickness as the finish ceiling material shall be installed directly above the top plate of bearing walls if the compressive strength of the finish ceiling material is less than the loads it will be required to withstand. The compression strip shall cover the entire length of such top plate and shall be at least ½ the width of the top plate. It shall be of material capable of transmitting the loads transferred through it.

**5802.7 Cutting and Notching.** Structural roof members shall not be cut, bored or notched in excess of the limitations specified in 780 CMR 5802.7.

**5802.7.1 Sawn Lumber.** Notches in solid lumber joists, rafters and beams shall not exceed 1/6 of the depth of the member, shall not be longer than ¼ of the depth of the member and shall not be located in the middle ½ of the span. Notches at the ends of the member shall not exceed ¼ the depth of the member. The tension side of members four inches (102 mm) or greater in nominal thickness shall not be notched except at the ends of the members. The diameter of the holes bored or cut into members shall not exceed ¼ the depth of the member. Holes shall not be closer than two inches (51 mm) to the top or bottom of the member, or to any other hole located in the

Tables 5802.5.1(1) through 5802.5.1(8). For other grades and species and for other loading conditions, refer to the AF&PA Span Tables for Joists and Rafters, or the AF&PA Maximum Span Calculator for Joists and Rafters. The span of each rafter shall be measured along the horizontal projection of the rafter.

member. Where the member is also notched, the hole shall not be closer than two inches (51 mm) to the notch.

**Exception:** Notches on cantilevered portions of rafters are permitted provided the dimension of the remaining portion of the rafter is not less than four-inch nominal (102 mm) and the length of the cantilever does not exceed 24 inches (610 mm).

**5802.7.2 Engineered Wood Products.** Cuts, notches and holes bored in laminated veneer lumber, glue-laminated members or I-joists are not permitted unless the effect of such penetrations are specifically considered in the design of the member.

**5802.8 Lateral Support.** Rafters and ceiling joists having a depth-to-thickness ratio exceeding five to one based on nominal dimensions shall be provided with lateral support at points of bearing to prevent rotation.

**5802.8.1 Bridging.** Rafters and ceiling joists having a depth-to-thickness ratio exceeding six to one based on nominal dimensions shall be supported laterally by solid blocking, diagonal bridging (wood or metal) or a continuous one-inch by three-inch (25.4 mm by 76 mm) wood strip nailed across the rafters or ceiling joists at intervals not exceeding eight feet (2438 mm).

**5802.9 Framing of Openings.** Openings in roof and ceiling framing shall be framed with header and trimmer joists. When the header joist span does not exceed four feet (1219 mm), the header joist may be a single member the same size as the ceiling joist or rafter. Single trimmer joists may be used to carry a single header joist that is located within three feet (914 mm) of the trimmer joist bearing. When the header joist span exceeds four feet (1219 mm), the trimmer joists and the header joist shall be doubled and of sufficient cross section to support the ceiling joists or rafter framing into the header. Approved hangers shall be used for the header joist to trimmer joist connections when the header joist span exceeds six feet (1829mm). Tail joists over 12 feet (3658 mm) long shall be supported at the header by framing anchors or on ledger strips not less than two inches by two inches (51 mm by 51 mm).

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**5802.10 Wood Trusses.**

**5802.10.1 Truss Design Drawings.** Truss design drawings, prepared in conformance with 780 CMR 5802.10.1, shall be provided to the building official and approved prior to installation. Truss design drawings shall include, at a minimum, the information specified below. Truss design drawing shall be provided with the shipment of trusses delivered to the jobsite.

1. Slope or depth, span and spacing.
2. Location of all joints.
3. Required bearing widths.
4. Design loads as applicable.

4.1. Top chord live load (including snow loads).

- 9.1. Truss to truss girder.
- 9.2. Truss ply to ply.
- 9.3. Field splices.

10. Calculated deflection ratio and/or maximum description for live and total load.
11. Maximum axial compression forces in the truss members to enable the building designer to design the size, connections and anchorage of the permanent continuous lateral bracing. Forces shall be shown on the truss design drawing or on supplemental documents.
12. Required permanent truss member bracing location.

**5802.10.2 Design.** Wood trusses shall be designed in accordance with accepted engineering practice. The design and manufacture of metal plate connected wood trusses shall comply with ANSI/TPI 1. The truss design drawings shall be prepared by a

- 4.2. Top chord dead load.
- 4.3. Bottom chord live load.
- 4.4. Bottom chord dead load.
- 4.5. Concentrated loads and their points of application.
- 4.6. *Controlling wind loads.*

5. Adjustments to lumber and joint connector design values for conditions of use.
6. Each reaction force and direction.
7. Joint connector type and description (e.g., size, thickness or gauge) and the dimensioned location of each joint connector except where symmetrically located relative to the joint interface.
8. Lumber size, species and grade for each member.
9. Connection requirements for:

*Massachusetts-registered architect or registered professional engineer.*

**5802.10.3 Bracing.** Trusses shall be braced to prevent rotation and provide lateral stability in accordance with the requirements specified in the construction documents for the building and on the individual truss design drawings. In the absence of specific bracing requirements, trusses shall be braced in accordance with Building Component Safety Information (BCSI 1-03) *Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses.*

**5802.10.4 Alterations to trusses.** Truss members shall not be cut, notched, drilled, spliced or otherwise altered in any way without the approval of a registered design professional. Alterations resulting in the addition of load (e.g., HVAC equipment, water heater) that exceeds the design load for the truss shall not be permitted without verification that the truss is capable of supporting such additional loading.

780 CMR TABLE 5802.4(1)  
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES  
Uninhabitable attics without storage, live load = 10 psf, L/Δ = 240)

| CEILING<br>JOISTSPACING(i<br>nches) | SPECIES AND GRADE |    | DEAD LOAD = 5 psf           |                 |                 |                 |
|-------------------------------------|-------------------|----|-----------------------------|-----------------|-----------------|-----------------|
|                                     |                   |    | 2 × 4                       | 2 × 6           | 2 × 8           | 2 × 10          |
|                                     |                   |    | Maximum ceiling joist spans |                 |                 |                 |
|                                     |                   |    | (feet - inches)             | (feet - inches) | (feet - inches) | (feet - inches) |
| 12                                  | Douglas fir-larch | SS | 13-2                        | 20-8            | Note a          | Note a          |
|                                     | Douglas fir-larch | #1 | 12-8                        | 19-11           | Note a          | Note a          |
|                                     | Douglas fir-larch | #2 | 12-5                        | 19-6            | 25-8            | Note a          |
|                                     | Douglas fir-larch | #3 | 10-10                       | 15-10           | 20-1            | 24-6            |
|                                     | Hem-fir           | SS | 12-5                        | 19-6            | 25-8            | Note a          |
|                                     | Hem-fir           | #1 | 12-2                        | 19-1            | 25-2            | Note a          |
|                                     | Hem-fir           | #2 | 11-7                        | 18-2            | 24-0            | Note a          |
|                                     | Hem-fir           | #3 | 10-10                       | 15-10           | 20-1            | 24-6            |
|                                     | Southern pine     | SS | 12-11                       | 20-3            | Note a          | Note a          |
|                                     | Southern pine     | #1 | 12-8                        | 19-11           | Note a          | Note a          |
|                                     | Southern pine     | #2 | 12-5                        | 19-6            | 25-8            | Note a          |
|                                     | Southern pine     | #3 | 11-6                        | 17-0            | 21-8            | 25-7            |
|                                     | Spruce-pine-fir   | SS | 12-2                        | 19-1            | 25-2            | Note a          |
|                                     | Spruce-pine-fir   | #1 | 11-10                       | 18-8            | 24-7            | Note a          |
|                                     | Spruce-pine-fir   | #2 | 11-10                       | 18-8            | 24-7            | Note a          |
|                                     | Spruce-pine-fir   | #3 | 10-10                       | 15-10           | 20-1            | 24-6            |
| 16                                  | Douglas fir-larch | SS | 11-11                       | 18-9            | 24-8            | Note a          |
|                                     | Douglas fir-larch | #1 | 11-6                        | 18-1            | 23-10           | Note a          |
|                                     | Douglas fir-larch | #2 | 11-3                        | 17-8            | 23-0            | Note a          |
|                                     | Douglas fir-larch | #3 | 9-5                         | 13-9            | 17-5            | 21-3            |
|                                     | Hem-fir           | SS | 11-3                        | 17-8            | 23-4            | Note a          |
|                                     | Hem-fir           | #1 | 11-0                        | 17-4            | 22-10           | Note a          |
|                                     | Hem-fir           | #2 | 10-6                        | 16-6            | 21-9            | Note a          |
|                                     | Hem-fir           | #3 | 9-5                         | 13-9            | 17-5            | 21-3            |
|                                     | Southern pine     | SS | 11-9                        | 18-5            | 24-3            | Note a          |
|                                     | Southern pine     | #1 | 11-6                        | 18-1            | 23-1            | Note a          |
|                                     | Southern pine     | #2 | 11-3                        | 17-8            | 23-4            | Note a          |
|                                     | Southern pine     | #3 | 10-0                        | 14-9            | 18-9            | 22-2            |
|                                     | Spruce-pine-fir   | SS | 11-0                        | 17-4            | 22-10           | Note a          |
|                                     | Spruce-pine-fir   | #1 | 10-9                        | 16-11           | 22-4            | Note a          |
|                                     | Spruce-pine-fir   | #2 | 10-9                        | 16-11           | 22-4            | Note a          |
|                                     | Spruce-pine-fir   | #3 | 9-5                         | 13-9            | 17-5            | 21-3            |
| 19.2                                | Douglas fir-larch | SS | 11-3                        | 17-8            | 23-3            | Note a          |
|                                     | Douglas fir-larch | #1 | 10-10                       | 17-0            | 22-5            | Note a          |
|                                     | Douglas fir-larch | #2 | 10-7                        | 16-7            | 21-0            | 25-8            |
|                                     | Douglas fir-larch | #3 | 8-7                         | 12-6            | 15-10           | 19-5            |
|                                     | Hem-fir           | SS | 10-7                        | 16-8            | 21-11           | Note a          |
|                                     | Hem-fir           | #1 | 10-4                        | 16-4            | 21-6            | Note a          |
|                                     | Hem-fir           | #2 | 9-11                        | 15-7            | 20-6            | 25-3            |
|                                     | Hem-fir           | #3 | 8-7                         | 12-6            | 15-10           | 19-5            |
|                                     | Southern -pine    | SS | 11-0                        | 17-4            | 22-10           | Note a          |
|                                     | Southern pine     | #1 | 10-10                       | 17-0            | 22-5            | Note a          |
|                                     | Southern pine     | #2 | 10-7                        | 16-8            | 21-11           | Note a          |
|                                     | Southern pine     | #3 | 9-1                         | 13-6            | 17-2            | 20-3            |
|                                     | Spruce-pine-fir   | SS | 10-4                        | 16-4            | 21-6            | Note a          |
|                                     | Spruce-pine-fir   | #1 | 10-2                        | 15-11           | 21-0            | 25-8            |
|                                     | Spruce-pine-fir   | #2 | 10-2                        | 15-11           | 21-0            | 25-8            |
|                                     | Spruce-pine-fir   | #3 | 8-7                         | 12-6            | 15-10           | 19-5            |

780 CMR TABLE 5802.4(1) - continued  
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES  
Uninhabitable attics without storage, live load = 10 psf, L/Δ = 240)

| CEILING<br>JOISTSPACING(i<br>nches) | SPECIES AND GRADE |    | DEAD LOAD = 5 psf           |                 |                 |                 |
|-------------------------------------|-------------------|----|-----------------------------|-----------------|-----------------|-----------------|
|                                     |                   |    | 2 × 4                       | 2 × 6           | 2 × 8           | 2 × 10          |
|                                     |                   |    | Maximum ceiling joist spans |                 |                 |                 |
|                                     |                   |    | (feet - inches)             | (feet - inches) | (feet - inches) | (feet - inches) |
| 24                                  | Douglas fir-larch | SS | 10-5                        | 16-4            | 21-7            | Note a          |
|                                     | Douglas fir-larch | #1 | 10-10                       | 15-9            | 20-1            | 24-6            |

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|  |                   |    |      |       |       |        |
|--|-------------------|----|------|-------|-------|--------|
|  | Douglas fir-larch | #2 | 9-10 | 14-10 | 18-9  | 22-11  |
|  | Douglas fir-larch | #3 | 7-8  | 11-2  | 14-2  | 17-4   |
|  | Hem-fir           | SS | 9-10 | 15-6  | 20-5  | Note a |
|  | Hem-fir           | #1 | 9-8  | 15-2  | 19-7  | 23-11  |
|  | Hem-fir           | #2 | 9-2  | 14-5  | 18-6  | 22-7   |
|  | Hem-fir           | #3 | 7-8  | 11-2  | 14-2  | 17-4   |
|  | Southern pine     | SS | 10-3 | 16-1  | 21-2  | Note a |
|  | Southern pine     | #1 | 10-0 | 15-9  | 20-10 | Note a |
|  | Southern pine     | #2 | 9-10 | 15-6  | 20-1  | 23-11  |
|  | Southern pine     | #3 | 8-2  | 12-0  | 15-4  | 18-1   |
|  | Spruce-pine-fir   | SS | 9-8  | 15-2  | 19-11 | 25-5   |
|  | Spruce-pine-fir   | #1 | 9-5  | 14-9  | 18-9  | 22-11  |
|  | Spruce-pine-fir   | #2 | 9-5  | 14-9  | 18-9  | 22-11  |
|  | Spruce-pine-fir   | #3 | 7-8  | 11-2  | 14-2  | 17-4   |

Check sources for availability of lumber in lengths greater than 20 feet.  
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m<sup>2</sup>.  
a. Span exceeds 26 feet in length.

**780 CMR TABLE 5802.4(2)**  
**CEILING JOIST SPANS FOR COMMON LUMBER SPECIES**  
**(Uninhabitable attics with limited storage, live load = 20 psf, L/Δ = 240)**

| CEILING<br>JOISTSPACING<br>(inches) | SPECIES AND GRADE |    | DEAD LOAD = 10 psf          |                 |                 |                 |
|-------------------------------------|-------------------|----|-----------------------------|-----------------|-----------------|-----------------|
|                                     |                   |    | 2 × 4                       | 2 × 6           | 2 × 8           | 2 × 10          |
|                                     |                   |    | Maximum ceiling joist spans |                 |                 |                 |
|                                     |                   |    | (feet - inches)             | (feet - inches) | (feet - inches) | (feet - inches) |
| 12                                  | Douglas fir-larch | SS | 10-5                        | 16-4            | 21-7            | Note a          |
|                                     | Douglas fir-larch | #1 | 10-0                        | 15-9            | 20-1            | 24-6            |
|                                     | Douglas fir-larch | #2 | 9-10                        | 14-10           | 18-9            | 22-11           |
|                                     | Douglas fir-larch | #3 | 7-8                         | 11-2            | 14-2            | 17-4            |
|                                     | Hem-fir           | SS | 9-10                        | 15-6            | 20-5            | Note a          |
|                                     | Hem-fir           | #1 | 9-8                         | 15-2            | 19-7            | 23-11           |
|                                     | Hem-fir           | #2 | 9-2                         | 14-5            | 18-6            | 22-7            |
|                                     | Hem-fir           | #3 | 7-8                         | 11-2            | 14-2            | 17-4            |
|                                     | Southern pine     | SS | 10-3                        | 16-1            | 21-2            | Note a          |
|                                     | Southern pine     | #1 | 10-0                        | 15-9            | 20-10           | Note a          |
|                                     | Southern pine     | #2 | 9-10                        | 15-6            | 20-1            | 23-11           |
|                                     | Southern pine     | #3 | 8-2                         | 12-0            | 15-4            | 18-1            |
|                                     | Spruce-pine-fir   | SS | 9-8                         | 15-2            | 19-11           | 25-5            |
|                                     | Spruce-pine-fir   | #1 | 9-5                         | 14-9            | 18-9            | 22-11           |
|                                     | Spruce-pine-fir   | #2 | 9-5                         | 14-9            | 18-9            | 22-11           |
|                                     | Spruce-pine-fir   | #3 | 7-8                         | 11-2            | 14-2            | 17-4            |
| 16                                  | Douglas fir-larch | SS | 9-6                         | 14-11           | 19-7            | 25-0            |
|                                     | Douglas fir-larch | #1 | 9-1                         | 13-9            | 17-5            | 21-3            |
|                                     | Douglas fir-larch | #2 | 8-9                         | 12-10           | 16-3            | 19-10           |
|                                     | Douglas fir-larch | #3 | 6-8                         | 9-8             | 12-4            | 15-0            |
|                                     | Hem-fir           | SS | 8-11                        | 14-1            | 18-6            | 23-8            |
|                                     | Hem-fir           | #1 | 8-9                         | 13-5            | 16-10           | 20-8            |
|                                     | Hem-fir           | #2 | 8-4                         | 12-8            | 16-0            | 19-7            |
|                                     | Hem-fir           | #3 | 6-8                         | 9-8             | 12-4            | 15-0            |
|                                     | Southern pine     | SS | 9-4                         | 14-7            | 19-3            | 24-7            |
|                                     | Southern pine     | #1 | 9-1                         | 14-4            | 18-11           | 23-1            |
|                                     | Southern pine     | #2 | 8-11                        | 13-6            | 17-5            | 20-9            |
|                                     | Southern pine     | #3 | 7-1                         | 10-5            | 13-3            | 15-8            |
|                                     | Spruce-pine-fir   | SS | 8-9                         | 13-9            | 18-1            | 23-1            |
|                                     | Spruce-pine-fir   | #1 | 8-7                         | 12-10           | 16-3            | 19-10           |
|                                     | Spruce-pine-fir   | #2 | 8-7                         | 12-10           | 16-3            | 19-10           |
|                                     | Spruce-pine-fir   | #3 | 6-8                         | 9-8             | 12-4            | 15-0            |
| 19.2                                | Douglas fir-larch | SS | 8-11                        | 14-0            | 18-5            | 23-4            |
|                                     | Douglas fir-larch | #1 | 8-7                         | 12-6            | 15-10           | 19-5            |
|                                     | Douglas fir-larch | #2 | 8-0                         | 11-9            | 14-10           | 18-2            |
|                                     | Douglas fir-larch | #3 | 6-1                         | 8-10            | 11-3            | 13-8            |
|                                     | Hem-fir           | SS | 8-5                         | 13-3            | 17-5            | 22-3            |
|                                     | Hem-fir           | #1 | 8-3                         | 12-3            | 15-6            | 18-11           |
|                                     | Hem-fir           | #2 | 7-10                        | 11-7            | 14-8            | 17-10           |
|                                     | Hem-fir           | #3 | 6-1                         | 8-10            | 11-3            | 13-8            |
|                                     | Southern pine     | SS | 8-9                         | 13-9            | 18-1            | 23-1            |
|                                     | Southern pine     | #1 | 8-7                         | 13-6            | 17-9            | 21-1            |
|                                     | Southern pine     | #2 | 8-5                         | 12-3            | 15-10           | 18-11           |
|                                     | Southern pine     | #3 | 6-5                         | 9-6             | 12-1            | 14-4            |
|                                     | Spruce-pine-fir   | SS | 8-3                         | 12-11           | 17-1            | 21-8            |
|                                     | Spruce-pine-fir   | #1 | 8-0                         | 11-9            | 14-10           | 18-2            |
|                                     | Spruce-pine-fir   | #2 | 8-0                         | 11-9            | 14-10           | 18-2            |
|                                     | Spruce-pine-fir   | #3 | 6-1                         | 8-10            | 11-3            | 13-8            |

**780 CMR TABLE 5802.4(2) - continued**  
**CEILING JOIST SPANS FOR COMMON LUMBER SPECIES**  
**(Uninhabitable attics with limited storage, live load = 20 psf, L/Δ = 240)**

| CEILING<br>JOISTSPACING<br>(inches) | SPECIES AND GRADE |    | DEAD LOAD = 10 psf          |                 |                 |                 |
|-------------------------------------|-------------------|----|-----------------------------|-----------------|-----------------|-----------------|
|                                     |                   |    | 2 × 4                       | 2 × 6           | 2 × 8           | 2 × 10          |
|                                     |                   |    | Maximum ceiling joist spans |                 |                 |                 |
|                                     |                   |    | (feet - inches)             | (feet - inches) | (feet - inches) | (feet - inches) |
| 24                                  | Douglas fir-larch | SS | 8-3                         | 13-0            | 17-1            | 20-11           |
|                                     | Douglas fir-larch | #1 | 7-8                         | 11-2            | 14-2            | 17-4            |

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|  |                   |    |      |       |       |       |
|--|-------------------|----|------|-------|-------|-------|
|  | Douglas fir-larch | #2 | 7-2  | 10-6  | 13-3  | 16-3  |
|  | Douglas fir-larch | #3 | 5-5  | 7-11  | 10-0  | 12-3  |
|  | Hem-fir           | SS | 7-10 | 12-3  | 16-2  | 20-6  |
|  | Hem-fir           | #1 | 7-6  | 10-11 | 13-10 | 16-11 |
|  | Hem-fir           | #2 | 7-1  | 10-4  | 13-1  | 16-0  |
|  | Hem-fir           | #3 | 5-5  | 7-11  | 10-0  | 12-3  |
|  | Southern pine     | SS | 8-1  | 12-9  | 16-10 | 21-6  |
|  | Southern pine     | #1 | 8-0  | 12-6  | 15-10 | 18-10 |
|  | Southern pine     | #2 | 7-8  | 11-0  | 14-2  | 16-11 |
|  | Southern pine     | #3 | 5-9  | 8-6   | 10-10 | 12-10 |
|  | Spruce-pine-fir   | SS | 7-8  | 12-0  | 15-10 | 19-5  |
|  | Spruce-pine-fir   | #1 | 7-2  | 10-6  | 13-3  | 16-3  |
|  | Spruce-pine-fir   | #2 | 7-2  | 10-6  | 13-3  | 16-3  |
|  | Spruce-pine-fir   | #3 | 5-5  | 7-11  | 10-0  | 12-3  |

Check sources for availability of lumber in lengths greater than 20 feet.  
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m<sup>2</sup>.  
a. Span exceeds 26 feet in length.



780 CMR TABLE 5802.5.1(1)  
RAFTER SPANS FOR COMMON LUMBER SPECIES  
(Roof live load=20 psf, ceiling not attached to rafters, L/Δ = 180)

| RAFTER<br>SPACING<br>(inches) | SPECIES AND GRADE |    | DEAD LOAD = 10 psf                |                     |                     |                     |                     | DEAD LOAD = 20 psf  |                     |                     |                     |                     |
|-------------------------------|-------------------|----|-----------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|                               |                   |    | 2 × 4                             | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              | 2 × 4               | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              |
|                               |                   |    | Maximum rafter spans <sup>a</sup> |                     |                     |                     |                     |                     |                     |                     |                     |                     |
|                               |                   |    | (feet - i<br>nches)               | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) |
| 12                            | Douglas fir-larch | SS | 11-6                              | 18-0                | 23-9                | Note b              | Note b              | 11-6                | 18-0                | 23-5                | Note b              | Note b              |
|                               | Douglas fir-larch | #1 | 11-1                              | 17-4                | 22-5                | Note b              | Note b              | 10-6                | 15-4                | 19-5                | 23-9                | Note b              |
|                               | Douglas fir-larch | #2 | 10-10                             | 16-7                | 21-0                | 25-8                | Note b              | 9-10                | 14-4                | 18-2                | 22-3                | 25-9                |
|                               | Douglas fir-larch | #3 | 8-7                               | 12-6                | 15-10               | 19-5                | 22-6                | 7-5                 | 10-10               | 13-9                | 16-9                | 19-6                |
|                               | Hem-fir           | SS | 10-10                             | 17-0                | 22-5                | Note b              | Note b              | 10-10               | 17-0                | 22-5                | Note b              | Note b              |
|                               | Hem-fir           | #1 | 10-7                              | 16-8                | 21-10               | Note b              | Note b              | 10-3                | 14-11               | 18-11               | 23-2                | Note b              |
|                               | Hem-fir           | #2 | 10-1                              | 15-11               | 20-8                | 25-3                | Note b              | 9-8                 | 14-2                | 17-11               | 21-11               | 25-5                |
|                               | Hem-fir           | #3 | 8-7                               | 12-6                | 15-10               | 19-5                | 22-6                | 7-5                 | 10-10               | 13-9                | 16-9                | 19-6                |
|                               | Southern pine     | SS | 11-3                              | 17-8                | 23-4                | Note b              | Note b              | 11-3                | 17-8                | 23-4                | Note b              | Note b              |
|                               | Southern pine     | #1 | 11-1                              | 17-4                | 22-11               | Note b              | Note b              | 11-1                | 17-3                | 21-9                | 25-10               | Note b              |
|                               | Southern pine     | #2 | 10-10                             | 17-0                | 22-5                | Note b              | Note b              | 10-6                | 15-1                | 19-5                | 23-2                | Note b              |
|                               | Southern pine     | #3 | 9-1                               | 13-6                | 17-2                | 20-3                | 24-1                | 7-11                | 11-8                | 14-10               | 17-6                | 20-11               |
|                               | Spruce-pine-fir   | SS | 10-7                              | 16-8                | 21-11               | Note b              | Note b              | 10-7                | 16-8                | 21-9                | Note b              | Note b              |
|                               | Spruce-pine-fir   | #1 | 10-4                              | 16-3                | 21-0                | 25-8                | Note b              | 9-10                | 14-4                | 18-2                | 22-3                | 25-9                |
|                               | Spruce-pine-fir   | #2 | 10-4                              | 16-3                | 21-0                | 25-8                | Note b              | 9-10                | 14-4                | 18-2                | 22-3                | 25-9                |
|                               | Spruce-pine-fir   | #3 | 8-7                               | 12-6                | 15-10               | 19-5                | 22-6                | 7-5                 | 10-10               | 13-9                | 16-9                | 19-6                |
| 16                            | Douglas fir-larch | SS | 10-5                              | 16-4                | 21-7                | Note b              | Note b              | 10-5                | 16-0                | 20-3                | 24-9                | Note b              |
|                               | Douglas fir-larch | #1 | 10-0                              | 15-4                | 19-5                | 23-9                | Note b              | 9-1                 | 13-3                | 16-10               | 20-7                | 23-10               |
|                               | Douglas fir-larch | #2 | 9-10                              | 14-4                | 18-2                | 22-3                | 25-9                | 8-6                 | 12-5                | 15-9                | 19-3                | 22-4                |
|                               | Douglas fir-larch | #3 | 7-5                               | 10-10               | 13-9                | 16-9                | 19-6                | 6-5                 | 9-5                 | 11-11               | 14-6                | 16-10               |
|                               | Hem-fir           | SS | 9-10                              | 15-6                | 20-5                | Note b              | Note b              | 9-10                | 15-6                | 19-11               | 24-4                | Note b              |
|                               | Hem-fir           | #1 | 9-8                               | 14-11               | 18-11               | 23-2                | Note b              | 8-10                | 12-11               | 16-5                | 20-0                | 23-3                |
|                               | Hem-fir           | #2 | 9-2                               | 14-2                | 17-11               | 21-11               | 25-5                | 8-5                 | 12-3                | 15-6                | 18-11               | 22-0                |
|                               | Hem-fir           | #3 | 7-5                               | 10-10               | 13-9                | 16-9                | 19-6                | 6-5                 | 9-5                 | 11-11               | 14-6                | 16-10               |
|                               | Southern pine     | SS | 10-3                              | 16-1                | 21-2                | Note b              | Note b              | 10-3                | 16-1                | 21-2                | Note b              | Note b              |
|                               | Southern pine     | #1 | 10-0                              | 15-9                | 20-10               | 25-10               | Note b              | 10-0                | 15-0                | 18-10               | 22-4                | Note b              |
|                               | Southern pine     | #2 | 9-10                              | 15-1                | 19-5                | 23-2                | Note b              | 9-1                 | 13-0                | 16-10               | 20-1                | 23-7                |
|                               | Southern pine     | #3 | 7-11                              | 11-8                | 14-10               | 17-6                | 20-11               | 6-10                | 10-1                | 12-10               | 15-2                | 18-1                |
|                               | Spruce-pine-fir   | SS | 9-8                               | 15-2                | 19-11               | 25-5                | Note b              | 9-8                 | 14-10               | 18-10               | 23-0                | Note b              |
|                               | Spruce-pine-fir   | #1 | 9-5                               | 14-4                | 18-2                | 22-3                | 25-9                | 8-6                 | 12-5                | 15-9                | 19-3                | 22-4                |
|                               | Spruce-pine-fir   | #2 | 9-5                               | 14-4                | 18-2                | 22-3                | 25-9                | 8-6                 | 12-5                | 15-9                | 19-3                | 22-4                |
|                               | Spruce-pine-fir   | #3 | 7-5                               | 10-10               | 13-9                | 16-9                | 19-6                | 6-5                 | 9-5                 | 11-11               | 14-6                | 16-10               |
| 19.2                          | Douglas fir-larch | SS | 9-10                              | 15-5                | 20-4                | 25-11               | Note b              | 9-10                | 14-7                | 18-6                | 22-7                | Note b              |
|                               | Douglas fir-larch | #1 | 9-5                               | 14-0                | 17-9                | 21-8                | 25-2                | 8-4                 | 12-2                | 15-4                | 18-9                | 21-9                |
|                               | Douglas fir-larch | #2 | 8-11                              | 13-1                | 16-7                | 20-3                | 23-6                | 7-9                 | 11-4                | 14-4                | 17-7                | 20-4                |
|                               | Douglas fir-larch | #3 | 6-9                               | 9-11                | 12-7                | 15-4                | 17-9                | 5-10                | 8-7                 | 10-10               | 13-3                | 15-5                |
|                               | Hem-fir           | SS | 9-3                               | 14-7                | 19-2                | 24-6                | Note b              | 9-3                 | 14-4                | 18-2                | 22-3                | 25-9                |
|                               | Hem-fir           | #1 | 9-1                               | 13-8                | 17-4                | 21-1                | 24-6                | 8-1                 | 11-10               | 15-0                | 18-4                | 21-3                |
|                               | Hem-fir           | #2 | 8-8                               | 12-11               | 16-4                | 20-0                | 23-2                | 7-8                 | 11-2                | 14-2                | 17-4                | 20-1                |
|                               | Hem-fir           | #3 | 6-9                               | 9-11                | 12-7                | 15-4                | 17-9                | 5-10                | 8-7                 | 10-10               | 13-3                | 15-5                |
|                               | Southern pine     | SS | 9-8                               | 15-2                | 19-11               | 25-5                | Note b              | 9-8                 | 15-2                | 19-11               | 25-5                | Note b              |
|                               | Southern pine     | #1 | 9-5                               | 14-10               | 19-7                | 23-7                | Note b              | 9-3                 | 13-8                | 17-2                | 20-5                | 24-4                |
|                               | Southern pine     | #2 | 9-3                               | 13-9                | 17-9                | 21-2                | 24-10               | 8-4                 | 11-11               | 15-4                | 18-4                | 21-6                |
|                               | Southern pine     | #3 | 7-3                               | 10-8                | 13-7                | 16-0                | 19-1                | 6-3                 | 9-3                 | 11-9                | 13-10               | 16-6                |
|                               | Spruce-pine-fir   | SS | 9-1                               | 14-3                | 18-9                | 23-11               | Note b              | 9-1                 | 13-7                | 17-2                | 21-0                | 24-4                |
|                               | Spruce-pine-fir   | #1 | 8-10                              | 13-1                | 16-7                | 20-3                | 23-6                | 7-9                 | 11-4                | 14-4                | 17-7                | 20-4                |
|                               | Spruce-pine-fir   | #2 | 8-10                              | 13-1                | 16-7                | 20-3                | 23-6                | 7-9                 | 11-4                | 14-4                | 17-7                | 20-4                |
|                               | Spruce-pine-fir   | #3 | 6-9                               | 9-11                | 12-7                | 15-4                | 17-9                | 5-10                | 8-7                 | 10-10               | 13-3                | 15-5                |

780 CMR TABLE 5802.5.1(1)- continued  
RAFTER SPANS FOR COMMON LUMBER SPECIES  
(Roof live load=20 psf, ceiling not attached to rafters, L/Δ = 180)

| RAFTER<br>SPACING<br>(inches) | SPECIES AND GRADE |  | DEAD LOAD = 10 psf                |                     |                     |                     |                     | DEAD LOAD = 20 psf  |                     |                     |                     |                     |
|-------------------------------|-------------------|--|-----------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|                               |                   |  | 2 × 4                             | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              | 2 × 4               | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              |
|                               |                   |  | Maximum rafter spans <sup>a</sup> |                     |                     |                     |                     |                     |                     |                     |                     |                     |
|                               |                   |  | (feet - i<br>nches)               | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) |

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|    |                   |    |      |      |       |       |        |      |       |       |       |        |
|----|-------------------|----|------|------|-------|-------|--------|------|-------|-------|-------|--------|
| 24 | Douglas fir-larch | SS | 9-1  | 14-4 | 18-10 | 23-4  | Note b | 8-11 | 13-1  | 16-7  | 20-3  | 23-5   |
|    | Douglas fir-larch | #1 | 8-7  | 12-6 | 15-10 | 19-5  | 22-6   | 7-5  | 10-10 | 13-9  | 16-9  | 19-6   |
|    | Douglas fir-larch | #2 | 8-0  | 11-9 | 14-10 | 18-2  | 21-0   | 6-11 | 10-2  | 12-10 | 15-8  | 18-3   |
|    | Douglas fir-larch | #3 | 6-1  | 8-10 | 11-3  | 13-8  | 15-11  | 5-3  | 7-8   | 9-9   | 11-10 | 13-9   |
|    | Hem-fir           | SS | 8-7  | 13-6 | 17-10 | 22-9  | Note b | 8-7  | 12-10 | 16-3  | 19-10 | 23-0   |
|    | Hem-fir           | #1 | 8-4  | 12-6 | 15-6  | 18-11 | 21-11  | 7-3  | 10-7  | 13-5  | 16-4  | 19-0   |
|    | Hem-fir           | #2 | 7-11 | 11-7 | 14-8  | 17-10 | 20-9   | 6-10 | 10-0  | 12-8  | 15-6  | 17-11  |
|    | Hem-fir           | #3 | 6-1  | 8-10 | 11-3  | 13-8  | 15-11  | 5-3  | 7-8   | 9-9   | 11-10 | 13-9   |
|    | Southern pine     | SS | 8-11 | 14-1 | 18-6  | 23-8  | Note b | 8-11 | 14-1  | 18-6  | 22-11 | Note b |
|    | Southern pine     | #1 | 8-9  | 13-9 | 17-9  | 21-1  | 25-2   | 8-3  | 12-3  | 15-4  | 18-3  | 21-9   |
|    | Southern pine     | #2 | 8-7  | 12-3 | 15-10 | 18-11 | 22-2   | 7-5  | 10-8  | 13-9  | 16-5  | 19-3   |
|    | Southern pine     | #3 | 6-5  | 9-6  | 12-1  | 14-4  | 17-1   | 5-7  | 8-3   | 10-6  | 12-5  | 14-9   |
|    | Spruce-pine-fir   | SS | 8-5  | 13-3 | 17-5  | 21-8  | 25-2   | 8-4  | 12-2  | 15-4  | 18-9  | 21-9   |
|    | Spruce-pine-fir   | #1 | 8-0  | 11-9 | 14-10 | 18-2  | 21-0   | 6-11 | 10-2  | 12-10 | 15-8  | 18-3   |
|    | Spruce-pine-fir   | #2 | 8-0  | 11-9 | 14-10 | 18-2  | 21-0   | 6-11 | 10-2  | 12-10 | 15-8  | 18-3   |
|    | Spruce-pine-fir   | #3 | 6-1  | 8-10 | 11-3  | 13-8  | 15-11  | 5-3  | 7-8   | 9-9   | 11-10 | 13-9   |

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

a. The tabulate drafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

| $H_C/H_R$      | Rafter Span Adjustment<br>Factor |
|----------------|----------------------------------|
| 2/3 or greater | 0.50                             |
| 1/2            | 0.58                             |
| 1/3            | 0.67                             |
| 1/4            | 0.76                             |
| 1/5            | 0.83                             |
| 1/6            | 0.90                             |
| 1/7.5 and less | 1.00                             |

where:  $H_C$  = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.  
 $H_R$  = Height of roof ridge measured vertically above the top of the rafter support walls.

b. Span exceeds 26 feet in length.

780 CMR TABLE 5802.5.1(2)  
RAFTER SPANS FOR COMMON LUMBER SPECIES  
(Roof live load=20 psf, ceiling attached to rafters, L/Δ = 240)

| RAFTER<br>SPACING<br>(inches) | SPECIES AND GRADE |    | DEAD LOAD = 10 psf                |                     |                     |                     |                     | DEAD LOAD = 20 psf  |                     |                     |                     |                     |
|-------------------------------|-------------------|----|-----------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|                               |                   |    | 2 × 4                             | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              | 2 × 4               | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              |
|                               |                   |    | Maximum rafter spans <sup>a</sup> |                     |                     |                     |                     |                     |                     |                     |                     |                     |
|                               |                   |    | (feet - i<br>nches)               | (feet - in<br>ches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) |
| 12                            | Douglas fir-larch | SS | 10-5                              | 16-4                | 21-7                | Note b              | Note b              | 10-5                | 16-4                | 21-7                | Note b              | Note b              |
|                               | Douglas fir-larch | #1 | 10-0                              | 15-9                | 20-10               | Note b              | Note b              | 10-0                | 15-4                | 19-5                | 23-9                | Note b              |
|                               | Douglas fir-larch | #2 | 9-10                              | 15-6                | 20-5                | 25-8                | Note b              | 9-10                | 14-4                | 18-2                | 22-3                | 25-9                |
|                               | Douglas fir-larch | #3 | 8-7                               | 12-6                | 15-10               | 19-5                | 22-6                | 7-5                 | 10-10               | 13-9                | 16-9                | 19-6                |
|                               | Hem-fir           | SS | 9-10                              | 15-6                | 20-5                | Note b              | Note b              | 9-10                | 15-6                | 20-5                | Note b              | Note b              |
|                               | Hem-fir           | #1 | 9-8                               | 15-2                | 19-11               | 25-5                | Note b              | 9-8                 | 14-11               | 18-11               | 23-2                | Note b              |
|                               | Hem-fir           | #2 | 9-2                               | 14-5                | 19-0                | 24-3                | Note b              | 9-2                 | 14-2                | 17-11               | 21-11               | 25-5                |
|                               | Hem-fir           | #3 | 8-7                               | 12-6                | 15-10               | 19-5                | 22-6                | 7-5                 | 10-10               | 13-9                | 16-9                | 19-6                |
|                               | Southern pine     | SS | 10-3                              | 16-1                | 21-2                | Note b              | Note b              | 10-3                | 16-1                | 21-2                | Note b              | Note b              |
|                               | Southern pine     | #1 | 10-0                              | 15-9                | 20-10               | Note b              | Note b              | 10-0                | 15-9                | 20-10               | 25-10               | Note b              |
|                               | Southern pine     | #2 | 9-10                              | 15-6                | 20-5                | Note b              | Note b              | 9-10                | 15-1                | 19-5                | 23-2                | Note b              |
|                               | Southern pine     | #3 | 9-1                               | 13-6                | 17-2                | 20-3                | 24-1                | 7-11                | 11-8                | 14-10               | 17-6                | 20-11               |
|                               | Spruce-pine-fir   | SS | 9-8                               | 15-2                | 19-11               | 25-5                | Note b              | 9-8                 | 15-2                | 19-11               | 25-5                | Note b              |
|                               | Spruce-pine-fir   | #1 | 9-5                               | 14-9                | 19-6                | 24-10               | Note b              | 9-5                 | 14-4                | 18-2                | 22-3                | 25-9                |
|                               | Spruce-pine-fir   | #2 | 9-5                               | 14-9                | 19-6                | 24-10               | Note b              | 9-5                 | 14-4                | 18-2                | 22-3                | 25-9                |
|                               | Spruce-pine-fir   | #3 | 8-7                               | 12-6                | 15-10               | 19-5                | 22-6                | 7-5                 | 10-10               | 13-9                | 16-9                | 19-6                |
| 16                            | Douglas fir-larch | SS | 9-6                               | 14-11               | 19-7                | 25-0                | Note b              | 9-6                 | 14-11               | 19-7                | 24-9                | Note b              |
|                               | Douglas fir-larch | #1 | 9-1                               | 14-4                | 18-11               | 23-9                | Note b              | 9-1                 | 13-3                | 16-10               | 20-7                | 23-10               |
|                               | Douglas fir-larch | #2 | 8-11                              | 14-1                | 18-2                | 22-3                | 25-9                | 8-6                 | 12-5                | 15-9                | 19-3                | 22-4                |
|                               | Douglas fir-larch | #3 | 7-5                               | 10-10               | 13-9                | 16-9                | 19-6                | 6-5                 | 9-5                 | 11-11               | 14-6                | 16-10               |
|                               | Hem-fir           | SS | 8-11                              | 14-1                | 18-6                | 23-8                | Note b              | 8-11                | 14-1                | 18-6                | 23-8                | Note b              |
|                               | Hem-fir           | #1 | 8-9                               | 13-9                | 18-1                | 23-1                | Note b              | 8-9                 | 12-11               | 16-5                | 20-0                | 23-3                |
|                               | Hem-fir           | #2 | 8-4                               | 13-1                | 17-3                | 21-11               | 25-5                | 8-4                 | 12-3                | 15-6                | 18-11               | 22-0                |
|                               | Hem-fir           | #3 | 7-5                               | 10-10               | 13-9                | 16-9                | 19-6                | 6-5                 | 9-5                 | 11-11               | 14-6                | 16-10               |
|                               | Southern pine     | SS | 9-4                               | 14-7                | 19-3                | 24-7                | Note b              | 9-4                 | 14-7                | 19-3                | 24-7                | Note b              |
|                               | Southern pine     | #1 | 9-1                               | 14-4                | 18-11               | 24-1                | Note b              | 9-1                 | 14-4                | 18-10               | 22-4                | Note b              |
|                               | Southern pine     | #2 | 8-11                              | 14-1                | 18-6                | 23-2                | Note b              | 8-11                | 13-0                | 16-10               | 20-1                | 23-7                |
|                               | Southern pine     | #3 | 7-11                              | 11-8                | 14-10               | 17-6                | 20-11               | 6-10                | 10-1                | 12-10               | 15-2                | 18-1                |
|                               | Spruce-pine-fir   | SS | 8-9                               | 13-9                | 18-1                | 23-1                | Note b              | 8-9                 | 13-9                | 18-1                | 23-0                | Note b              |
|                               | Spruce-pine-fir   | #1 | 8-7                               | 13-5                | 17-9                | 22-3                | 25-9                | 8-6                 | 12-5                | 15-9                | 19-3                | 22-4                |
|                               | Spruce-pine-fir   | #2 | 8-7                               | 13-5                | 17-9                | 22-3                | 25-9                | 8-6                 | 12-5                | 15-9                | 19-3                | 22-4                |
|                               | Spruce-pine-fir   | #3 | 7-5                               | 10-10               | 13-9                | 16-9                | 19-6                | 6-5                 | 9-5                 | 11-11               | 14-6                | 16-10               |
| 19.2                          | Douglas fir-larch | SS | 8-11                              | 14-0                | 18-5                | 23-7                | Note b              | 8-11                | 14-0                | 18-5                | 22-7                | Note b              |
|                               | Douglas fir-larch | #1 | 8-7                               | 13-6                | 17-9                | 21-8                | 25-2                | 8-4                 | 12-2                | 15-4                | 18-9                | 21-9                |
|                               | Douglas fir-larch | #2 | 8-5                               | 13-1                | 16-7                | 20-3                | 23-6                | 7-9                 | 11-4                | 14-4                | 17-7                | 20-4                |
|                               | Douglas fir-larch | #3 | 6-9                               | 9-11                | 12-7                | 15-4                | 17-9                | 5-10                | 8-7                 | 10-10               | 13-3                | 15-5                |
|                               | Hem-fir           | SS | 8-5                               | 13-3                | 17-5                | 22-3                | Note b              | 8-5                 | 13-3                | 17-5                | 22-3                | 25-9                |
|                               | Hem-fir           | #1 | 8-3                               | 12-11               | 17-1                | 21-1                | 24-6                | 8-1                 | 11-10               | 15-0                | 18-4                | 21-3                |
|                               | Hem-fir           | #2 | 7-10                              | 12-4                | 16-3                | 20-0                | 23-2                | 7-8                 | 11-2                | 14-2                | 17-4                | 20-1                |
|                               | Hem-fir           | #3 | 6-9                               | 9-11                | 12-7                | 15-4                | 17-9                | 5-10                | 8-7                 | 10-10               | 13-3                | 15-5                |
|                               | Southern pine     | SS | 8-9                               | 13-9                | 18-1                | 23-1                | Note b              | 8-9                 | 13-9                | 18-1                | 23-1                | Note b              |
|                               | Southern pine     | #1 | 8-7                               | 13-6                | 17-9                | 22-8                | Note b              | 8-7                 | 13-6                | 17-2                | 20-5                | 24-4                |
|                               | Southern pine     | #2 | 8-5                               | 13-3                | 17-5                | 21-2                | 24-10               | 8-4                 | 11-11               | 15-4                | 18-4                | 21-6                |
|                               | Southern pine     | #3 | 7-3                               | 10-8                | 13-7                | 16-0                | 19-1                | 6-3                 | 9-3                 | 11-9                | 13-10               | 16-6                |
|                               | Spruce-pine-fir   | SS | 8-3                               | 12-11               | 17-1                | 21-9                | Note b              | 8-3                 | 12-11               | 17-1                | 21-0                | 24-4                |
|                               | Spruce-pine-fir   | #1 | 8-1                               | 12-8                | 16-7                | 20-3                | 23-6                | 7-9                 | 11-4                | 14-4                | 17-7                | 20-4                |
|                               | Spruce-pine-fir   | #2 | 8-1                               | 12-8                | 16-7                | 20-3                | 23-6                | 7-9                 | 11-4                | 14-4                | 17-7                | 20-4                |
|                               | Spruce-pine-fir   | #3 | 6-9                               | 9-11                | 12-7                | 15-4                | 17-9                | 5-10                | 8-7                 | 10-10               | 13-3                | 15-5                |

780 CMR TABLE 5802.5.1(2) - continued  
RAFTER SPANS FOR COMMON LUMBER SPECIES  
(Roof live load=20 psf, ceiling attached to rafters, L/Δ = 240)

| RAFTER<br>SPACING<br>(inches) | SPECIES AND GRADE |  | DEAD LOAD = 10 psf                |                     |                     |                     |                     | DEAD LOAD = 20 psf  |                     |                     |                     |                     |
|-------------------------------|-------------------|--|-----------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|                               |                   |  | 2 × 4                             | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              | 2 × 4               | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              |
|                               |                   |  | Maximum rafter spans <sup>a</sup> |                     |                     |                     |                     |                     |                     |                     |                     |                     |
|                               |                   |  | (feet - i<br>nches)               | (feet - in<br>ches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) |

THE MASSACHUSETTS STATE BUILDING CODE

|    |                   |    |      |      |       |       |        |      |       |       |       |        |
|----|-------------------|----|------|------|-------|-------|--------|------|-------|-------|-------|--------|
| 24 | Douglas fir-larch | SS | 8-3  | 13-0 | 17-2  | 21-10 | Note b | 8-3  | 13-0  | 16-7  | 20-3  | 23-5   |
|    | Douglas fir-larch | #1 | 8-0  | 12-6 | 15-10 | 19-5  | 22-6   | 7-5  | 10-10 | 13-9  | 16-9  | 19-6   |
|    | Douglas fir-larch | #2 | 7-10 | 11-9 | 14-10 | 18-2  | 21-0   | 6-11 | 10-2  | 12-10 | 15-8  | 18-3   |
|    | Douglas fir-larch | #3 | 6-1  | 8-10 | 11-3  | 13-8  | 15-11  | 5-3  | 7-8   | 9-9   | 11-10 | 13-9   |
|    | Hem-fir           | SS | 7-10 | 12-3 | 16-2  | 20-8  | 25-1   | 7-10 | 12-3  | 16-2  | 19-10 | 23-0   |
|    | Hem-fir           | #1 | 7-8  | 12-0 | 15-6  | 18-11 | 21-11  | 7-3  | 10-7  | 13-5  | 16-4  | 19-0   |
|    | Hem-fir           | #2 | 7-3  | 11-5 | 14-8  | 17-10 | 20-9   | 6-10 | 10-0  | 12-8  | 15-6  | 17-11  |
|    | Hem-fir           | #3 | 6-1  | 8-10 | 11-3  | 13-8  | 15-11  | 5-3  | 7-8   | 9-9   | 11-10 | 13-9   |
|    | Southern pine     | SS | 8-1  | 12-9 | 16-10 | 21-6  | Note b | 8-1  | 12-9  | 16-10 | 21-6  | Note b |
|    | Southern pine     | #1 | 8-0  | 12-6 | 16-6  | 21-1  | 25-2   | 8-0  | 12-3  | 15-4  | 18-3  | 21-9   |
|    | Southern pine     | #2 | 7-10 | 12-3 | 15-10 | 18-11 | 22-2   | 7-5  | 10-8  | 13-9  | 16-5  | 19-3   |
|    | Southern pine     | #3 | 6-5  | 9-6  | 12-1  | 14-4  | 17-1   | 5-7  | 8-3   | 10-6  | 12-5  | 14-9   |
|    | Spruce-pine-fir   | SS | 7-8  | 12-0 | 15-10 | 20-2  | 24-7   | 7-8  | 12-0  | 15-4  | 18-9  | 21-9   |
|    | Spruce-pine-fir   | #1 | 7-6  | 11-9 | 14-10 | 18-2  | 21-0   | 6-11 | 10-2  | 12-10 | 15-8  | 18-3   |
|    | Spruce-pine-fir   | #2 | 7-6  | 11-9 | 14-10 | 18-2  | 21-0   | 6-11 | 10-2  | 12-10 | 15-8  | 18-3   |
|    | Spruce-pine-fir   | #3 | 6-1  | 8-10 | 11-3  | 13-8  | 15-11  | 5-3  | 7-8   | 9-9   | 11-10 | 13-9   |

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m<sup>2</sup>.

a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

| $H_C/H_R$      | Rafter Span Adjustment<br>Factor |
|----------------|----------------------------------|
| 2/3 or greater | 0.50                             |
| 1/2            | 0.58                             |
| 1/3            | 0.67                             |
| 1/4            | 0.76                             |
| 1/5            | 0.83                             |
| 1/6            | 0.90                             |
| 1/7.5 and less | 1.00                             |

where:  $H_C$  = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.  
 $H_R$  = Height of roof ridge measured vertically above the top of the rafter support walls.

b. Span exceeds 26 feet in length.

780 CMR TABLE 5802.5.1(3)  
RAFTER SPANS FOR COMMON LUMBER SPECIES  
(Ground snow load=30 psf, ceiling not attached to rafters, L/Δ= 180)

| RAFTER<br>SPACING<br>(inches) | SPECIES AND GRADE |    | DEAD LOAD = 10 psf                |                     |                     |                     |                     | DEAD LOAD = 20 psf  |                     |                     |                     |                     |
|-------------------------------|-------------------|----|-----------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|                               |                   |    | 2 × 4                             | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              | 2 × 4               | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              |
|                               |                   |    | Maximum rafter spans <sup>a</sup> |                     |                     |                     |                     |                     |                     |                     |                     |                     |
|                               |                   |    | (feet - i<br>nches)               | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) |
| 12                            | Douglas fir-larch | SS | 10-0                              | 15-9                | 20-9                | Note b              | Note b              | 10-0                | 15-9                | 20-1                | 24-6                | Note b              |
|                               | Douglas fir-larch | #1 | 9-8                               | 14-9                | 18-8                | 22-9                | Note b              | 9-0                 | 13-2                | 16-8                | 20-4                | 23-7                |
|                               | Douglas fir-larch | #2 | 9-5                               | 13-9                | 17-5                | 21-4                | 24-8                | 8-5                 | 12-4                | 15-7                | 19-1                | 22-1                |
|                               | Douglas fir-larch | #3 | 7-1                               | 10-5                | 13-2                | 16-1                | 18-8                | 6-4                 | 9-4                 | 11-9                | 14-5                | 16-8                |
|                               | Hem-fir           | SS | 9-6                               | 14-10               | 19-7                | 25-0                | Note b              | 9-6                 | 14-10               | 19-7                | 24-1                | Note b              |
|                               | Hem-fir           | #1 | 9-3                               | 14-4                | 18-2                | 22-2                | 25-9                | 8-9                 | 12-10               | 16-3                | 19-10               | 23-0                |
|                               | Hem-fir           | #2 | 8-10                              | 13-7                | 17-2                | 21-0                | 24-4                | 8-4                 | 12-2                | 15-4                | 18-9                | 21-9                |
|                               | Hem-fir           | #3 | 7-1                               | 10-5                | 13-2                | 16-1                | 18-8                | 6-4                 | 9-4                 | 11-9                | 14-5                | 16-8                |
|                               | Southern pine     | SS | 9-10                              | 15-6                | 20-5                | Note b              | Note b              | 9-10                | 15-6                | 20-5                | Note b              | Note b              |
|                               | Southern pine     | #1 | 9-8                               | 15-2                | 20-0                | 24-9                | Note b              | 9-8                 | 14-10               | 18-8                | 22-2                | Note b              |
|                               | Southern pine     | #2 | 9-6                               | 14-5                | 18-8                | 22-3                | Note b              | 9-0                 | 12-11               | 16-8                | 19-11               | 23-4                |
|                               | Southern pine     | #3 | 7-7                               | 11-2                | 14-3                | 16-10               | 20-0                | 6-9                 | 10-0                | 12-9                | 15-1                | 17-11               |
|                               | Spruce-pine-fir   | SS | 9-3                               | 14-7                | 19-2                | 24-6                | Note b              | 9-3                 | 14-7                | 18-8                | 22-9                | Note b              |
|                               | Spruce-pine-fir   | #1 | 9-1                               | 13-9                | 17-5                | 21-4                | 24-8                | 8-5                 | 12-4                | 15-7                | 19-1                | 22-1                |
|                               | Spruce-pine-fir   | #2 | 9-1                               | 13-9                | 17-5                | 21-4                | 24-8                | 8-5                 | 12-4                | 15-7                | 19-1                | 22-1                |
|                               | Spruce-pine-fir   | #3 | 7-1                               | 10-5                | 13-2                | 16-1                | 18-8                | 6-4                 | 9-4                 | 11-9                | 14-5                | 16-8                |
| 16                            | Douglas fir-larch | SS | 9-1                               | 14-4                | 18-10               | 23-9                | Note b              | 9-1                 | 13-9                | 17-5                | 21-3                | 24-8                |
|                               | Douglas fir-larch | #1 | 8-9                               | 12-9                | 16-2                | 19-9                | 22-10               | 7-10                | 11-5                | 14-5                | 17-8                | 20-5                |
|                               | Douglas fir-larch | #2 | 8-2                               | 11-11               | 15-1                | 18-5                | 21-5                | 7-3                 | 10-8                | 13-6                | 16-6                | 19-2                |
|                               | Douglas fir-larch | #3 | 6-2                               | 9-0                 | 11-5                | 13-11               | 16-2                | 5-6                 | 8-1                 | 10-3                | 12-6                | 14-6                |
|                               | Hem-fir           | SS | 8-7                               | 13-6                | 17-10               | 22-9                | Note b              | 8-7                 | 13-6                | 17-1                | 20-10               | 24-2                |
|                               | Hem-fir           | #1 | 8-5                               | 12-5                | 15-9                | 19-3                | 22-3                | 7-7                 | 11-1                | 14-1                | 17-2                | 19-11               |
|                               | Hem-fir           | #2 | 8-0                               | 11-9                | 14-11               | 18-2                | 21-1                | 7-2                 | 10-6                | 13-4                | 16-3                | 18-10               |
|                               | Hem-fir           | #3 | 6-2                               | 9-0                 | 11-5                | 13-11               | 16-2                | 5-6                 | 8-1                 | 10-3                | 12-6                | 14-6                |
|                               | Southern pine     | SS | 8-11                              | 14-1                | 18-6                | 23-8                | Note b              | 8-11                | 14-1                | 18-6                | 23-8                | Note b              |
|                               | Southern pine     | #1 | 8-9                               | 13-9                | 18-1                | 21-5                | 25-7                | 8-8                 | 12-10               | 16-2                | 19-2                | 22-10               |
|                               | Southern pine     | #2 | 8-7                               | 12-6                | 16-2                | 19-3                | 22-7                | 7-10                | 11-2                | 14-5                | 17-3                | 20-2                |
|                               | Southern pine     | #3 | 6-7                               | 9-8                 | 12-4                | 14-7                | 17-4                | 5-10                | 8-8                 | 11-0                | 13-0                | 15-6                |
|                               | Spruce-pine-fir   | SS | 8-5                               | 13-3                | 17-5                | 22-1                | 25-7                | 8-5                 | 12-9                | 16-2                | 19-9                | 22-10               |
|                               | Spruce-pine-fir   | #1 | 8-2                               | 11-11               | 15-1                | 18-5                | 21-5                | 7-3                 | 10-8                | 13-6                | 16-6                | 19-2                |
|                               | Spruce-pine-fir   | #2 | 8-2                               | 11-11               | 15-1                | 18-5                | 21-5                | 7-3                 | 10-8                | 13-6                | 16-6                | 19-2                |
|                               | Spruce-pine-fir   | #3 | 6-2                               | 9-0                 | 11-5                | 13-11               | 16-2                | 5-6                 | 8-1                 | 10-3                | 12-6                | 14-6                |
| 19.2                          | Douglas fir-larch | SS | 8-7                               | 13-6                | 17-9                | 21-8                | 25-2                | 8-7                 | 12-6                | 15-10               | 19-5                | 22-6                |
|                               | Douglas fir-larch | #1 | 7-11                              | 11-8                | 14-9                | 18-0                | 20-11               | 7-1                 | 10-5                | 13-2                | 16-1                | 18-8                |
|                               | Douglas fir-larch | #2 | 7-5                               | 10-11               | 13-9                | 16-10               | 19-6                | 6-8                 | 9-9                 | 12-4                | 15-1                | 17-6                |
|                               | Douglas fir-larch | #3 | 5-7                               | 8-3                 | 10-5                | 12-9                | 14-9                | 5-0                 | 7-4                 | 9-4                 | 11-5                | 13-2                |
|                               | Hem-fir           | SS | 8-1                               | 12-9                | 16-9                | 21-4                | 24-8                | 8-1                 | 12-4                | 15-7                | 19-1                | 22-1                |
|                               | Hem-fir           | #1 | 7-9                               | 11-4                | 14-4                | 17-7                | 20-4                | 6-11                | 10-2                | 12-10               | 15-8                | 18-2                |
|                               | Hem-fir           | #2 | 7-4                               | 10-9                | 13-7                | 16-7                | 19-3                | 6-7                 | 9-7                 | 12-2                | 14-10               | 17-3                |
|                               | Hem-fir           | #3 | 5-7                               | 8-3                 | 10-5                | 12-9                | 14-9                | 5-0                 | 7-4                 | 9-4                 | 11-5                | 13-2                |
|                               | Southern pine     | SS | 8-5                               | 13-3                | 17-5                | 22-3                | Note b              | 8-5                 | 13-3                | 17-5                | 22-0                | 25-9                |
|                               | Southern pine     | #1 | 8-3                               | 13-0                | 16-6                | 19-7                | 23-4                | 7-11                | 11-9                | 14-9                | 17-6                | 20-11               |
|                               | Southern pine     | #2 | 7-11                              | 11-5                | 14-9                | 17-7                | 20-7                | 7-1                 | 10-2                | 13-2                | 15-9                | 18-5                |
|                               | Southern pine     | #3 | 6-0                               | 8-10                | 11-3                | 13-4                | 15-10               | 5-4                 | 7-11                | 10-1                | 11-11               | 14-2                |
|                               | Spruce-pine-fir   | SS | 7-11                              | 12-5                | 16-5                | 20-2                | 23-4                | 7-11                | 11-8                | 14-9                | 18-0                | 20-11               |
|                               | Spruce-pine-fir   | #1 | 7-5                               | 10-11               | 13-9                | 16-10               | 19-6                | 6-8                 | 9-9                 | 12-4                | 15-1                | 17-6                |
|                               | Spruce-pine-fir   | #2 | 7-5                               | 10-11               | 13-9                | 16-10               | 19-6                | 6-8                 | 9-9                 | 12-4                | 15-1                | 17-6                |
|                               | Spruce-pine-fir   | #3 | 5-7                               | 8-3                 | 10-5                | 12-9                | 14-9                | 5-0                 | 7-4                 | 9-4                 | 11-5                | 13-2                |

780 CMR TABLE 5802.5.1(3) - continued  
RAFTER SPANS FOR COMMON LUMBER SPECIES  
(Ground snow load=30 psf, ceiling not attached to rafters, L/Δ= 180)

| RAFTER<br>SPACING<br>(inches) | SPECIES AND GRADE |  | DEAD LOAD = 10 psf                |                     |                     |                     |                     | DEAD LOAD = 20 psf  |                     |                     |                     |                     |
|-------------------------------|-------------------|--|-----------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|                               |                   |  | 2 × 4                             | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              | 2 × 4               | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              |
|                               |                   |  | Maximum rafter spans <sup>a</sup> |                     |                     |                     |                     |                     |                     |                     |                     |                     |
|                               |                   |  | (feet - i<br>nches)               | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) |

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THE MASSACHUSETTS STATE BUILDING CODE

|    |                   |    |      |       |       |       |       |      |      |       |      |       |
|----|-------------------|----|------|-------|-------|-------|-------|------|------|-------|------|-------|
| 24 | Douglas fir-larch | SS | 7-11 | 12-6  | 15-10 | 19-5  | 22-6  | 7-8  | 11-3 | 14-2  | 17-4 | 20-1  |
|    | Douglas fir-larch | #1 | 7-1  | 10-5  | 13-2  | 16-1  | 18-8  | 6-4  | 9-4  | 11-9  | 14-5 | 16-8  |
|    | Douglas fir-larch | #2 | 6-8  | 9-9   | 12-4  | 15-1  | 17-6  | 5-11 | 8-8  | 11-0  | 13-6 | 15-7  |
|    | Douglas fir-larch | #3 | 5-0  | 7-4   | 9-4   | 11-5  | 13-2  | 4-6  | 6-7  | 8-4   | 10-2 | 11-10 |
|    | Hem-fir           | SS | 7-6  | 11-10 | 15-7  | 19-1  | 22-1  | 7-6  | 11-0 | 13-11 | 17-0 | 19-9  |
|    | Hem-fir           | #1 | 6-11 | 10-2  | 12-10 | 15-8  | 18-2  | 6-2  | 9-1  | 11-6  | 14-0 | 16-3  |
|    | Hem-fir           | #2 | 6-7  | 9-7   | 12-2  | 14-10 | 17-3  | 5-10 | 8-7  | 10-10 | 13-3 | 15-5  |
|    | Hem-fir           | #3 | 5-0  | 7-4   | 9-4   | 11-5  | 13-2  | 4-6  | 6-7  | 8-4   | 10-2 | 11-10 |
|    | Southern pine     | SS | 7-10 | 12-3  | 16-2  | 20-8  | 25-1  | 7-10 | 12-3 | 16-2  | 19-8 | 23-0  |
|    | Southern pine     | #1 | 7-8  | 11-9  | 14-9  | 17-6  | 20-11 | 7-1  | 10-6 | 13-2  | 15-8 | 18-8  |
|    | Southern pine     | #2 | 7-1  | 10-2  | 13-2  | 15-9  | 18-5  | 6-4  | 9-2  | 11-9  | 14-1 | 16-6  |
|    | Southern pine     | #3 | 5-4  | 7-11  | 10-1  | 11-11 | 14-2  | 4-9  | 7-1  | 9-0   | 10-8 | 12-8  |
|    | Spruce-pine-fir   | SS | 7-4  | 11-7  | 14-9  | 18-0  | 20-11 | 7-1  | 10-5 | 13-2  | 16-1 | 18-8  |
|    | Spruce-pine-fir   | #1 | 6-8  | 9-9   | 12-4  | 15-1  | 17-6  | 5-11 | 8-8  | 11-0  | 13-6 | 15-7  |
|    | Spruce-pine-fir   | #2 | 6-8  | 9-9   | 12-4  | 15-1  | 17-6  | 5-11 | 8-8  | 11-0  | 13-6 | 15-7  |
|    | Spruce-pine-fir   | #3 | 5-0  | 7-4   | 9-4   | 11-5  | 13-2  | 4-6  | 6-7  | 8-4   | 10-2 | 11-10 |

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m<sup>2</sup>.

a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

| $H_C/H_R$      | Rafter Span Adjustment Factor |
|----------------|-------------------------------|
| 2/3 or greater | 0.50                          |
| 1/2            | 0.58                          |
| 1/3            | 0.67                          |
| 1/4            | 0.76                          |
| 1/5            | 0.83                          |
| 1/6            | 0.90                          |
| 1/7.5 and less | 1.00                          |

where:  $H_C$  = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.  $H_R$  = Height of roof ridge measured vertically above the top of the rafter support walls.

b. Span exceeds 26 feet in length.

780 CMR TABLE 5802.5.1(4)  
RAFTER SPANS FOR COMMON LUMBER SPECIES  
(Ground snow load=50 psf, ceiling not attached to rafters, L/Δ= 180)

| RAFTER<br>SPACING<br>(inches) | SPECIES AND GRADE |    | DEAD LOAD = 10 psf                |                     |                     |                     |                     | DEAD LOAD = 20 psf  |                     |                     |                     |                     |
|-------------------------------|-------------------|----|-----------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|                               |                   |    | 2 × 4                             | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              | 2 × 4               | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              |
|                               |                   |    | Maximum rafter spans <sup>a</sup> |                     |                     |                     |                     |                     |                     |                     |                     |                     |
|                               |                   |    | (feet - i<br>nches)               | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) |
| 12                            | Douglas fir-larch | SS | 8-5                               | 13-3                | 17-6                | 22-4                | 26-0                | 8-5                 | 13-3                | 17-0                | 20-9                | 24-0                |
|                               | Douglas fir-larch | #1 | 8-2                               | 12-0                | 15-3                | 18-7                | 21-7                | 7-7                 | 11-2                | 14-1                | 17-3                | 20-0                |
|                               | Douglas fir-larch | #2 | 7-8                               | 11-3                | 14-3                | 17-5                | 20-2                | 7-1                 | 10-5                | 13-2                | 16-1                | 18-8                |
|                               | Douglas fir-larch | #3 | 5-10                              | 8-6                 | 10-9                | 13-2                | 15-3                | 5-5                 | 7-10                | 10-0                | 12-2                | 14-1                |
|                               | Hem-fir           | SS | 8-0                               | 12-6                | 16-6                | 21-1                | 25-6                | 8-0                 | 12-6                | 16-6                | 20-4                | 23-7                |
|                               | Hem-fir           | #1 | 7-10                              | 11-9                | 14-10               | 18-1                | 21-0                | 7-5                 | 10-10               | 13-9                | 16-9                | 19-5                |
|                               | Hem-fir           | #2 | 7-5                               | 11-1                | 14-0                | 17-2                | 19-11               | 7-0                 | 10-3                | 13-0                | 15-10               | 18-5                |
|                               | Hem-fir           | #3 | 5-10                              | 8-6                 | 10-9                | 13-2                | 15-3                | 5-5                 | 7-10                | 10-0                | 12-2                | 14-1                |
|                               | Southern pine     | SS | 8-4                               | 13-0                | 17-2                | 21-11               | Note b              | 8-4                 | 13-0                | 17-2                | 21-11               | Note b              |
|                               | Southern pine     | #1 | 8-2                               | 12-10               | 16-10               | 20-3                | 24-1                | 8-2                 | 12-6                | 15-9                | 18-9                | 22-4                |
|                               | Southern pine     | #2 | 8-0                               | 11-9                | 15-3                | 18-2                | 21-3                | 7-7                 | 10-11               | 14-1                | 16-10               | 19-9                |
|                               | Southern pine     | #3 | 6-2                               | 9-2                 | 11-8                | 13-9                | 16-4                | 5-9                 | 8-5                 | 10-9                | 12-9                | 15-2                |
|                               | Spruce-pine-fir   | SS | 7-10                              | 12-3                | 16-2                | 20-8                | 24-1                | 7-10                | 12-3                | 15-9                | 19-3                | 22-4                |
|                               | Spruce-pine-fir   | #1 | 7-8                               | 11-3                | 14-3                | 17-5                | 20-2                | 7-1                 | 10-5                | 13-2                | 16-1                | 18-8                |
|                               | Spruce-pine-fir   | #2 | 7-8                               | 11-3                | 14-3                | 17-5                | 15-2                | 7-1                 | 10-5                | 13-2                | 16-1                | 18-8                |
|                               | Spruce-pine-fir   | #3 | 5-10                              | 8-6                 | 10-9                | 13-2                | 20-3                | 5-5                 | 7-10                | 10-0                | 12-2                | 14-1                |
| 16                            | Douglas fir-larch | SS | 7-8                               | 12-1                | 15-10               | 19-5                | 22-6                | 7-8                 | 11-7                | 14-8                | 17-11               | 20-10               |
|                               | Douglas fir-larch | #1 | 7-1                               | 10-5                | 13-2                | 16-1                | 18-8                | 6-7                 | 9-8                 | 12-2                | 14-11               | 17-3                |
|                               | Douglas fir-larch | #2 | 6-8                               | 9-9                 | 12-4                | 15-1                | 17-6                | 6-2                 | 9-0                 | 11-5                | 13-11               | 16-2                |
|                               | Douglas fir-larch | #3 | 5-0                               | 7-4                 | 9-4                 | 11-5                | 13-2                | 4-8                 | 6-10                | 8-8                 | 10-6                | 12-3                |
|                               | Hem-fir           | SS | 7-3                               | 11-5                | 15-0                | 19-1                | 22-1                | 7-3                 | 11-5                | 14-5                | 17-8                | 20-5                |
|                               | Hem-fir           | #1 | 6-11                              | 10-2                | 12-10               | 15-8                | 18-2                | 6-5                 | 9-5                 | 11-11               | 14-6                | 16-10               |
|                               | Hem-fir           | #2 | 6-7                               | 9-7                 | 12-2                | 14-10               | 17-3                | 6-1                 | 8-11                | 11-3                | 13-9                | 15-11               |
|                               | Hem-fir           | #3 | 5-0                               | 7-4                 | 9-4                 | 11-5                | 13-2                | 4-8                 | 6-10                | 8-8                 | 10-6                | 12-3                |
|                               | Southern pine     | SS | 7-6                               | 11-10               | 15-7                | 19-11               | 24-3                | 7-6                 | 11-10               | 15-7                | 19-11               | 23-10               |
|                               | Southern pine     | #1 | 7-5                               | 11-7                | 14-9                | 17-6                | 20-11               | 7-4                 | 10-10               | 13-8                | 16-2                | 19-4                |
|                               | Southern pine     | #2 | 7-1                               | 10-2                | 13-2                | 15-9                | 18-5                | 6-7                 | 9-5                 | 12-2                | 14-7                | 17-1                |
|                               | Southern pine     | #3 | 5-4                               | 7-11                | 10-1                | 11-11               | 14-2                | 4-11                | 7-4                 | 9-4                 | 11-0                | 13-1                |
|                               | Spruce-pine-fir   | SS | 7-1                               | 11-2                | 14-8                | 18-0                | 20-11               | 7-1                 | 10-9                | 13-8                | 15-11               | 19-4                |
|                               | Spruce-pine-fir   | #1 | 6-8                               | 9-9                 | 12-4                | 15-1                | 17-6                | 6-2                 | 9-0                 | 11-5                | 13-11               | 16-2                |
|                               | Spruce-pine-fir   | #2 | 6-8                               | 9-9                 | 12-4                | 15-1                | 17-6                | 6-2                 | 9-0                 | 11-5                | 13-11               | 16-2                |
|                               | Spruce-pine-fir   | #3 | 5-0                               | 7-4                 | 9-4                 | 11-5                | 13-2                | 4-8                 | 6-10                | 8-8                 | 10-6                | 12-3                |
| 19.2                          | Douglas fir-larch | SS | 7-3                               | 11-4                | 14-6                | 17-8                | 20-6                | 7-3                 | 10-7                | 13-5                | 16-5                | 19-0                |
|                               | Douglas fir-larch | #1 | 6-6                               | 9-6                 | 12-0                | 14-8                | 17-1                | 6-0                 | 8-10                | 11-2                | 13-7                | 15-9                |
|                               | Douglas fir-larch | #2 | 6-1                               | 8-11                | 11-3                | 13-9                | 15-11               | 5-7                 | 8-3                 | 10-5                | 12-9                | 14-9                |
|                               | Douglas fir-larch | #3 | 4-7                               | 6-9                 | 8-6                 | 10-5                | 12-1                | 4-3                 | 6-3                 | 7-11                | 9-7                 | 11-2                |
|                               | Hem-fir           | SS | 6-10                              | 10-9                | 14-2                | 17-5                | 20-2                | 6-10                | 10-5                | 13-2                | 16-1                | 18-8                |
|                               | Hem-fir           | #1 | 6-4                               | 9-3                 | 11-9                | 14-4                | 16-7                | 5-10                | 8-7                 | 10-10               | 13-3                | 15-5                |
|                               | Hem-fir           | #2 | 6-0                               | 8-9                 | 11-1                | 13-7                | 15-9                | 5-7                 | 8-1                 | 10-3                | 12-7                | 14-7                |
|                               | Hem-fir           | #3 | 4-7                               | 6-9                 | 8-6                 | 10-5                | 12-1                | 4-3                 | 6-3                 | 7-11                | 9-7                 | 11-2                |
|                               | Southern pine     | SS | 7-1                               | 11-2                | 14-8                | 18-9                | 22-10               | 7-1                 | 11-2                | 14-8                | 18-7                | 21-9                |
|                               | Southern pine     | #1 | 7-0                               | 10-8                | 13-5                | 16-0                | 19-1                | 6-8                 | 9-11                | 12-5                | 14-10               | 17-8                |
|                               | Southern pine     | #2 | 6-6                               | 9-4                 | 12-0                | 14-4                | 16-10               | 6-0                 | 8-8                 | 11-2                | 13-4                | 15-7                |
|                               | Southern pine     | #3 | 4-11                              | 7-3                 | 9-2                 | 10-10               | 12-11               | 4-6                 | 6-8                 | 8-6                 | 10-1                | 12-0                |
|                               | Spruce-pine-fir   | SS | 6-8                               | 10-6                | 13-5                | 16-5                | 19-1                | 6-8                 | 9-10                | 12-5                | 15-3                | 17-8                |
|                               | Spruce-pine-fir   | #1 | 6-1                               | 8-11                | 11-3                | 13-9                | 15-11               | 5-7                 | 8-3                 | 10-5                | 12-9                | 14-9                |
|                               | Spruce-pine-fir   | #2 | 6-1                               | 8-11                | 11-3                | 13-9                | 15-11               | 5-7                 | 8-3                 | 10-5                | 12-9                | 14-9                |
|                               | Spruce-pine-fir   | #3 | 4-7                               | 6-9                 | 8-6                 | 10-5                | 12-1                | 4-3                 | 6-3                 | 7-11                | 9-7                 | 11-2                |

780 CMR TABLE 5802.5.1(4) - continued  
RAFTER SPANS FOR COMMON LUMBER SPECIES  
(Ground snow load=50 psf, ceiling not attached to rafters, L/Δ= 180)

| RAFTER<br>SPACING<br>(inches) | SPECIES AND GRADE |  | DEAD LOAD = 10 psf                |                     |                     |                     |                     | DEAD LOAD = 20 psf  |                     |                     |                     |                     |
|-------------------------------|-------------------|--|-----------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|                               |                   |  | 2 × 4                             | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              | 2 × 4               | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              |
|                               |                   |  | Maximum rafter spans <sup>a</sup> |                     |                     |                     |                     |                     |                     |                     |                     |                     |
|                               |                   |  | (feet - i<br>nches)               | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) |

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|    |                   |    |      |      |      |       |       |      |      |      |       |       |
|----|-------------------|----|------|------|------|-------|-------|------|------|------|-------|-------|
| 24 | Douglas fir-larch | SS | 6-8  | 10-5 | 13-0 | 15-10 | 18-4  | 6-6  | 9-6  | 12-0 | 14-8  | 17-0  |
|    | Douglas fir-larch | #1 | 5-10 | 8-6  | 10-9 | 13-2  | 15-3  | 5-5  | 7-10 | 10-0 | 12-2  | 14-1  |
|    | Douglas fir-larch | #2 | 5-5  | 7-11 | 10-1 | 12-4  | 14-3  | 5-0  | 7-4  | 9-4  | 11-5  | 13-2  |
|    | Douglas fir-larch | #3 | 4-1  | 6-0  | 7-7  | 9-4   | 10-9  | 3-10 | 5-7  | 7-1  | 8-7   | 10-0  |
|    | Hem-fir           | SS | 6-4  | 9-11 | 12-9 | 15-7  | 18-0  | 6-4  | 9-4  | 11-9 | 14-5  | 16-8  |
|    | Hem-fir           | #1 | 5-8  | 8-3  | 10-6 | 12-10 | 14-10 | 5-3  | 7-8  | 9-9  | 11-10 | 13-9  |
|    | Hem-fir           | #2 | 5-4  | 7-10 | 9-11 | 12-1  | 14-1  | 4-11 | 7-3  | 9-2  | 11-3  | 13-0  |
|    | Hem-fir           | #3 | 4-1  | 6-0  | 7-7  | 9-4   | 10-9  | 3-10 | 5-7  | 7-1  | 8-7   | 10-0  |
|    | Southern pine     | SS | 6-7  | 10-4 | 13-8 | 17-5  | 21-0  | 6-7  | 10-4 | 13-8 | 16-7  | 19-5  |
|    | Southern pine     | #1 | 6-5  | 9-7  | 12-0 | 14-4  | 17-1  | 6-0  | 8-10 | 11-2 | 13-3  | 15-9  |
|    | Southern pine     | #2 | 5-10 | 8-4  | 10-9 | 12-10 | 15-1  | 5-5  | 7-9  | 10-0 | 11-11 | 13-11 |
|    | Southern pine     | #3 | 4-4  | 6-5  | 8-3  | 9-9   | 11-7  | 4-1  | 6-0  | 7-7  | 9-0   | 10-8  |
|    | Spruce-pine-fir   | SS | 6-2  | 9-6  | 12-0 | 14-8  | 17-1  | 6-0  | 8-10 | 11-2 | 13-7  | 15-9  |
|    | Spruce-pine-fir   | #1 | 5-5  | 7-11 | 10-1 | 12-4  | 14-3  | 5-0  | 7-4  | 9-4  | 11-5  | 13-2  |
|    | Spruce-pine-fir   | #2 | 5-5  | 7-11 | 10-1 | 12-4  | 14-3  | 5-0  | 7-4  | 9-4  | 11-5  | 13-2  |
|    | Spruce-pine-fir   | #3 | 4-1  | 6-0  | 7-7  | 9-4   | 10-9  | 3-10 | 5-7  | 7-1  | 8-7   | 10-0  |

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m<sup>2</sup>.

a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

| $H_C/H_R$      | Rafter Span Adjustment<br>Factor |
|----------------|----------------------------------|
| 2/3 or greater | 0.50                             |
| 1/2            | 0.58                             |
| 1/3            | 0.67                             |
| 1/4            | 0.76                             |
| 1/5            | 0.83                             |
| 1/6            | 0.90                             |
| 1/7.5 and less | 1.00                             |

where:  $H_C$  = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.

$H_R$  = Height of roof ridge measured vertically above the top of the rafter support walls.

b. Span exceeds 26 feet in length.



780 CMR TABLE 5802.5.1(5)  
RAFTER SPANS FOR COMMON LUMBER SPECIES  
(Ground snow load=30 psf, ceiling attached to rafters, L/Δ = 240)

| RAFTER<br>SPACING<br>(inches) | SPECIES AND GRADE |    | DEAD LOAD = 10 psf                |                     |                     |                     |                     | DEAD LOAD = 20 psf  |                     |                     |                     |                     |
|-------------------------------|-------------------|----|-----------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|                               |                   |    | 2 × 4                             | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              | 2 × 4               | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              |
|                               |                   |    | Maximum rafter spans <sup>a</sup> |                     |                     |                     |                     |                     |                     |                     |                     |                     |
|                               |                   |    | (feet - i<br>nches)               | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) |
| 12                            | Douglas fir-larch | SS | 9-1                               | 14-4                | 18-10               | 24-1                | Note b              | 9-1                 | 14-4                | 18-10               | 24-1                | Note b              |
|                               | Douglas fir-larch | #1 | 8-9                               | 13-9                | 18-2                | 22-9                | Note b              | 8-9                 | 13-2                | 16-8                | 20-4                | 23-7                |
|                               | Douglas fir-larch | #2 | 8-7                               | 13-6                | 17-5                | 21-4                | 24-8                | 8-5                 | 12-4                | 15-7                | 19-1                | 22-1                |
|                               | Douglas fir-larch | #3 | 7-1                               | 10-5                | 13-2                | 16-1                | 18-8                | 6-4                 | 9-4                 | 11-9                | 14-5                | 16-8                |
|                               | Hem-fir           | SS | 8-7                               | 13-6                | 17-10               | 22-9                | Note b              | 8-7                 | 13-6                | 17-10               | 22-9                | Note b              |
|                               | Hem-fir           | #1 | 8-5                               | 13-3                | 17-5                | 22-2                | 25-9                | 8-5                 | 12-10               | 16-3                | 19-10               | 23-0                |
|                               | Hem-fir           | #2 | 8-0                               | 12-7                | 16-7                | 21-0                | 24-4                | 8-0                 | 12-2                | 15-4                | 18-9                | 21-9                |
|                               | Hem-fir           | #3 | 7-1                               | 10-5                | 13-2                | 16-1                | 18-8                | 6-4                 | 9-4                 | 11-9                | 14-5                | 16-8                |
|                               | Southern pine     | SS | 8-11                              | 14-1                | 18-6                | 23-8                | Note b              | 8-11                | 14-1                | 18-6                | 23-8                | Note b              |
|                               | Southern pine     | #1 | 8-9                               | 13-9                | 18-2                | 23-2                | Note b              | 8-9                 | 13-9                | 18-2                | 22-2                | Note b              |
|                               | Southern pine     | #2 | 8-7                               | 13-6                | 17-10               | 22-3                | Note b              | 8-7                 | 12-11               | 16-8                | 19-11               | 23-4                |
|                               | Southern pine     | #3 | 7-7                               | 11-2                | 14-3                | 16-10               | 20-0                | 6-9                 | 10-0                | 12-9                | 15-1                | 17-11               |
|                               | Spruce-pine-fir   | SS | 8-5                               | 13-3                | 17-5                | 22-3                | Note b              | 8-5                 | 13-3                | 17-5                | 22-3                | Note b              |
|                               | Spruce-pine-fir   | #1 | 8-3                               | 12-11               | 17-0                | 21-4                | 24-8                | 8-3                 | 12-4                | 15-7                | 19-1                | 22-1                |
|                               | Spruce-pine-fir   | #2 | 8-3                               | 12-11               | 17-0                | 21-4                | 24-8                | 8-3                 | 12-4                | 15-7                | 19-1                | 22-1                |
|                               | Spruce-pine-fir   | #3 | 7-1                               | 10-5                | 13-2                | 16-1                | 18-8                | 6-4                 | 9-4                 | 11-9                | 14-5                | 16-8                |
| 16                            | Douglas fir-larch | SS | 8-3                               | 13-0                | 17-2                | 21-10               | Note b              | 8-3                 | 13-0                | 17-2                | 21-3                | 24-8                |
|                               | Douglas fir-larch | #1 | 8-0                               | 12-6                | 16-2                | 19-9                | 22-10               | 7-10                | 11-5                | 14-5                | 17-8                | 20-5                |
|                               | Douglas fir-larch | #2 | 7-10                              | 11-11               | 15-1                | 18-5                | 21-5                | 7-3                 | 10-8                | 13-6                | 16-6                | 19-2                |
|                               | Douglas fir-larch | #3 | 6-2                               | 9-0                 | 11-5                | 13-11               | 16-2                | 5-6                 | 8-1                 | 10-3                | 12-6                | 14-6                |
|                               | Hem-fir           | SS | 7-10                              | 12-3                | 16-2                | 20-8                | 25-1                | 7-10                | 12-3                | 16-2                | 20-8                | 24-2                |
|                               | Hem-fir           | #1 | 7-8                               | 12-0                | 15-9                | 19-3                | 22-3                | 7-7                 | 11-1                | 14-1                | 17-2                | 19-11               |
|                               | Hem-fir           | #2 | 7-3                               | 11-5                | 14-11               | 18-2                | 21-1                | 7-2                 | 10-6                | 13-4                | 16-3                | 18-10               |
|                               | Hem-fir           | #3 | 6-2                               | 9-0                 | 11-5                | 13-11               | 16-2                | 5-6                 | 8-1                 | 10-3                | 12-6                | 14-6                |
|                               | Southern pine     | SS | 8-1                               | 12-9                | 16-10               | 21-6                | Note b              | 8-1                 | 12-9                | 16-10               | 21-6                | Note b              |
|                               | Southern pine     | #1 | 8-0                               | 12-6                | 16-6                | 21-1                | 25-7                | 8-0                 | 12-6                | 16-2                | 19-2                | 22-10               |
|                               | Southern pine     | #2 | 7-10                              | 12-3                | 16-2                | 19-3                | 22-7                | 7-10                | 11-2                | 14-5                | 17-3                | 20-2                |
|                               | Southern pine     | #3 | 6-7                               | 9-8                 | 12-4                | 14-7                | 17-4                | 5-10                | 8-8                 | 11-0                | 13-0                | 15-6                |
|                               | Spruce-pine-fir   | SS | 7-8                               | 12-0                | 15-10               | 20-2                | 24-7                | 7-8                 | 12-0                | 15-10               | 19-9                | 22-10               |
|                               | Spruce-pine-fir   | #1 | 7-6                               | 11-9                | 15-1                | 18-5                | 21-5                | 7-3                 | 10-8                | 13-6                | 16-6                | 19-2                |
|                               | Spruce-pine-fir   | #2 | 7-6                               | 11-9                | 15-1                | 18-5                | 21-5                | 7-3                 | 10-8                | 13-6                | 16-6                | 19-2                |
|                               | Spruce-pine-fir   | #3 | 6-2                               | 9-0                 | 11-5                | 13-11               | 16-2                | 5-6                 | 8-1                 | 10-3                | 12-6                | 14-6                |
| 19.2                          | Douglas fir-larch | SS | 7-9                               | 12-3                | 16-1                | 20-7                | 25-0                | 7-9                 | 12-3                | 15-10               | 19-5                | 22-6                |
|                               | Douglas fir-larch | #1 | 7-6                               | 11-8                | 14-9                | 18-0                | 20-11               | 7-1                 | 10-5                | 13-2                | 16-1                | 18-8                |
|                               | Douglas fir-larch | #2 | 7-4                               | 10-11               | 13-9                | 16-10               | 19-6                | 6-8                 | 9-9                 | 12-4                | 15-1                | 17-6                |
|                               | Douglas fir-larch | #3 | 5-7                               | 8-3                 | 10-5                | 12-9                | 14-9                | 5-0                 | 7-4                 | 9-4                 | 11-5                | 13-2                |
|                               | Hem-fir           | SS | 7-4                               | 11-7                | 15-3                | 19-5                | 23-7                | 7-4                 | 11-7                | 15-3                | 19-1                | 22-1                |
|                               | Hem-fir           | #1 | 7-2                               | 11-4                | 14-4                | 17-7                | 20-4                | 6-11                | 10-2                | 12-10               | 15-8                | 18-2                |
|                               | Hem-fir           | #2 | 6-10                              | 10-9                | 13-7                | 16-7                | 19-3                | 6-7                 | 9-7                 | 12-2                | 14-10               | 17-3                |
|                               | Hem-fir           | #3 | 5-7                               | 8-3                 | 10-5                | 12-9                | 14-9                | 5-0                 | 7-4                 | 9-4                 | 11-5                | 13-2                |
|                               | Southern pine     | SS | 7-8                               | 12-0                | 15-10               | 20-2                | 24-7                | 7-8                 | 12-0                | 15-10               | 20-2                | 24-7                |
|                               | Southern pine     | #1 | 7-6                               | 11-9                | 15-6                | 19-7                | 23-4                | 7-6                 | 11-9                | 14-9                | 17-6                | 20-11               |
|                               | Southern pine     | #2 | 7-4                               | 11-5                | 14-9                | 17-7                | 20-7                | 7-1                 | 10-2                | 13-2                | 15-9                | 18-5                |
|                               | Southern pine     | #3 | 6-0                               | 8-10                | 11-3                | 13-4                | 15-10               | 5-4                 | 7-11                | 10-1                | 11-11               | 14-2                |
|                               | Spruce-pine-fir   | SS | 7-2                               | 11-4                | 14-11               | 19-0                | 23-1                | 7-2                 | 11-4                | 14-9                | 18-0                | 20-11               |
|                               | Spruce-pine-fir   | #1 | 7-0                               | 10-11               | 13-9                | 16-10               | 19-6                | 6-8                 | 9-9                 | 12-4                | 15-1                | 17-6                |
|                               | Spruce-pine-fir   | #2 | 7-0                               | 10-11               | 13-9                | 16-10               | 19-6                | 6-8                 | 9-9                 | 12-4                | 15-1                | 17-6                |
|                               | Spruce-pine-fir   | #3 | 5-7                               | 8-3                 | 10-5                | 12-9                | 14-9                | 5-0                 | 7-4                 | 9-4                 | 11-5                | 13-2                |

780 CMR TABLE 5802.5.1(5) - continued  
RAFTER SPANS FOR COMMON LUMBER SPECIES  
(Ground snow load=30 psf, ceiling attached to rafters, L/Δ = 240)

| RAFTER<br>SPACING<br>(inches) | SPECIES AND GRADE |  | DEAD LOAD = 10 psf                |                     |                     |                     |                     | DEAD LOAD = 20 psf  |                     |                     |                     |                     |
|-------------------------------|-------------------|--|-----------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|                               |                   |  | 2 × 4                             | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              | 2 × 4               | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              |
|                               |                   |  | Maximum rafter spans <sup>a</sup> |                     |                     |                     |                     |                     |                     |                     |                     |                     |
|                               |                   |  | (feet - i<br>nches)               | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) |

780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS

THE MASSACHUSETTS STATE BUILDING CODE

|    |                   |    |      |       |       |       |       |      |      |       |      |       |
|----|-------------------|----|------|-------|-------|-------|-------|------|------|-------|------|-------|
| 24 | Douglas fir-larch | SS | 7-3  | 11-4  | 15-0  | 19-1  | 22-6  | 7-3  | 11-3 | 14-2  | 17-4 | 20-1  |
|    | Douglas fir-larch | #1 | 7-0  | 10-5  | 13-2  | 16-1  | 18-8  | 6-4  | 9-4  | 11-9  | 14-5 | 16-8  |
|    | Douglas fir-larch | #2 | 6-8  | 9-9   | 12-4  | 15-1  | 17-6  | 5-11 | 8-8  | 11-0  | 13-6 | 15-7  |
|    | Douglas fir-larch | #3 | 5-0  | 7-4   | 9-4   | 11-5  | 13-2  | 4-6  | 6-7  | 8-4   | 10-2 | 11-10 |
|    | Hem-fir           | SS | 6-10 | 10-9  | 14-2  | 18-0  | 21-11 | 6-10 | 10-9 | 13-11 | 17-0 | 19-9  |
|    | Hem-fir           | #1 | 6-8  | 10-2  | 12-10 | 15-8  | 18-2  | 6-2  | 9-1  | 11-6  | 14-0 | 16-3  |
|    | Hem-fir           | #2 | 6-4  | 9-7   | 12-2  | 14-10 | 17-3  | 5-10 | 8-7  | 10-10 | 13-3 | 15-5  |
|    | Hem-fir           | #3 | 5-0  | 7-4   | 9-4   | 11-5  | 13-2  | 4-6  | 6-7  | 8-4   | 10-2 | 11-10 |
|    | Southern pine     | SS | 7-1  | 11-2  | 14-8  | 18-9  | 22-10 | 7-1  | 11-2 | 14-8  | 18-9 | 22-10 |
|    | Southern pine     | #1 | 7-0  | 10-11 | 14-5  | 17-6  | 20-11 | 7-0  | 10-6 | 13-2  | 15-8 | 18-8  |
|    | Southern pine     | #2 | 6-10 | 10-2  | 13-2  | 15-9  | 18-5  | 6-4  | 9-2  | 11-9  | 14-1 | 16-6  |
|    | Southern pine     | #3 | 5-4  | 7-11  | 10-1  | 11-11 | 14-2  | 4-9  | 7-1  | 9-0   | 10-8 | 12-8  |
|    | Spruce-pine-fir   | SS | 6-8  | 10-6  | 13-10 | 17-8  | 20-11 | 6-8  | 10-5 | 13-2  | 16-1 | 18-8  |
|    | Spruce-pine-fir   | #1 | 6-6  | 9-9   | 12-4  | 15-1  | 17-6  | 5-11 | 8-8  | 11-10 | 13-6 | 15-7  |
|    | Spruce-pine-fir   | #2 | 6-6  | 9-9   | 12-4  | 15-1  | 17-6  | 5-11 | 8-8  | 11-10 | 13-6 | 15-7  |
|    | Spruce-pine-fir   | #3 | 5-0  | 7-4   | 9-4   | 11-5  | 13-2  | 4-6  | 6-7  | 8-4   | 10-2 | 11-10 |

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m<sup>2</sup>.

a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

| $H_C/H_R$      | Rafter Span Adjustment<br>Factor |
|----------------|----------------------------------|
| 2/3 or greater | 0.50                             |
| 1/2            | 0.58                             |
| 1/3            | 0.67                             |
| 1/4            | 0.76                             |
| 1/5            | 0.83                             |
| 1/6            | 0.90                             |
| 1/7.5 and less | 1.00                             |

where:  $H_C$  = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.  
 $H_R$  = Height of roof ridge measured vertically above the top of the rafter support walls.

b. Span exceeds 26 feet in length.

780 CMR TABLE 5802.5.1(6)  
RAFTER SPANS FOR COMMON LUMBER SPECIES  
(Ground snow load=50 psf, ceiling attached to rafters, L/Δ = 240)

| RAFTER<br>SPACING<br>(inches) | SPECIES AND GRADE |    | DEAD LOAD = 10 psf                |                    |                    |                    |                    | DEAD LOAD = 20 psf |                    |                    |                    |                   |
|-------------------------------|-------------------|----|-----------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|-------------------|
|                               |                   |    | 2 × 4                             | 2 × 6              | 2 × 8              | 2 × 10             | 2 × 12             | 2 × 4              | 2 × 6              | 2 × 8              | 2 × 10             | 2 × 12            |
|                               |                   |    | Maximum rafter spans <sup>a</sup> |                    |                    |                    |                    |                    |                    |                    |                    |                   |
|                               |                   |    | (feet- in<br>ches)                | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet-<br>inches) |
| 12                            | Douglas fir-larch | SS | 7-8                               | 12-1               | 15-11              | 20-3               | 24-8               | 7-8                | 12-1               | 15-11              | 20-3               | 24-0              |
|                               | Douglas fir-larch | #1 | 7-5                               | 11-7               | 15-3               | 18-7               | 21-7               | 7-5                | 11-2               | 14-1               | 17-3               | 20-0              |
|                               | Douglas fir-larch | #2 | 7-3                               | 11-3               | 14-3               | 17-5               | 20-2               | 7-1                | 10-5               | 13-2               | 16-1               | 18-8              |
|                               | Douglas fir-larch | #3 | 5-10                              | 8-6                | 10-9               | 13-2               | 15-3               | 5-5                | 7-10               | 10-0               | 12-2               | 14-1              |
|                               | Hem-fir           | SS | 7-3                               | 11-5               | 15-0               | 19-2               | 23-4               | 7-3                | 11-5               | 15-0               | 19-2               | 23-4              |
|                               | Hem-fir           | #1 | 7-1                               | 11-2               | 14-8               | 18-1               | 21-0               | 7-1                | 10-10              | 13-9               | 16-9               | 19-5              |
|                               | Hem-fir           | #2 | 6-9                               | 10-8               | 14-0               | 17-2               | 19-11              | 6-9                | 10-3               | 13-0               | 15-10              | 18-5              |
|                               | Hem-fir           | #3 | 5-10                              | 8-6                | 10-9               | 13-2               | 15-3               | 5-5                | 7-10               | 10-0               | 12-2               | 14-1              |
|                               | Southern pine     | SS | 7-6                               | 11-10              | 15-7               | 19-11              | 24-3               | 7-6                | 11-10              | 15-7               | 19-11              | 24-3              |
|                               | Southern pine     | #1 | 7-5                               | 11-7               | 15-4               | 19-7               | 23-9               | 7-5                | 11-7               | 15-4               | 18-9               | 22-4              |
|                               | Southern pine     | #2 | 7-3                               | 11-5               | 15-0               | 18-2               | 21-3               | 7-3                | 10-11              | 14-1               | 16-10              | 19-9              |
|                               | Southern pine     | #3 | 6-2                               | 9-2                | 11-8               | 13-9               | 16-4               | 5-9                | 8-5                | 10-9               | 12-9               | 15-2              |
|                               | Spruce-pine-fir   | SS | 7-1                               | 11-2               | 14-8               | 18-9               | 22-10              | 7-1                | 11-2               | 14-8               | 18-9               | 22-4              |
|                               | Spruce-pine-fir   | #1 | 6-11                              | 10-11              | 14-3               | 17-5               | 20-2               | 6-11               | 10-5               | 13-2               | 16-1               | 18-8              |
|                               | Spruce-pine-fir   | #2 | 6-11                              | 10-11              | 14-3               | 17-5               | 20-2               | 6-11               | 10-5               | 13-2               | 16-1               | 18-8              |
|                               | Spruce-pine-fir   | #3 | 5-10                              | 8-6                | 10-9               | 13-2               | 15-3               | 5-5                | 7-10               | 10-0               | 12-2               | 14-1              |
| 16                            | Douglas fir-larch | SS | 7-0                               | 11-0               | 14-5               | 18-5               | 22-5               | 7-0                | 11-0               | 14-5               | 17-11              | 20-10             |
|                               | Douglas fir-larch | #1 | 6-9                               | 10-5               | 13-2               | 16-1               | 18-8               | 6-7                | 9-8                | 12-2               | 14-11              | 17-3              |
|                               | Douglas fir-larch | #2 | 6-7                               | 9-9                | 12-4               | 15-1               | 17-6               | 6-2                | 9-0                | 11-5               | 13-11              | 16-2              |
|                               | Douglas fir-larch | #3 | 5-0                               | 7-4                | 9-4                | 11-5               | 13-2               | 4-8                | 6-10               | 8-8                | 10-6               | 12-3              |
|                               | Hem-fir           | SS | 6-7                               | 10-4               | 13-8               | 17-5               | 21-2               | 6-7                | 10-4               | 13-8               | 17-5               | 20-5              |
|                               | Hem-fir           | #1 | 6-5                               | 10-2               | 12-10              | 15-8               | 18-2               | 6-5                | 9-5                | 11-11              | 14-6               | 16-10             |
|                               | Hem-fir           | #2 | 6-2                               | 9-7                | 12-2               | 14-10              | 17-3               | 6-1                | 8-11               | 11-3               | 13-9               | 15-11             |
|                               | Hem-fir           | #3 | 5-0                               | 7-4                | 9-4                | 11-5               | 13-2               | 4-8                | 6-10               | 8-8                | 10-6               | 12-3              |
|                               | Southern pine     | SS | 6-10                              | 10-9               | 14-2               | 18-1               | 22-0               | 6-10               | 10-9               | 14-2               | 18-1               | 22-0              |
|                               | Southern pine     | #1 | 6-9                               | 10-7               | 13-11              | 17-6               | 20-11              | 6-9                | 10-7               | 13-8               | 16-2               | 19-4              |
|                               | Southern pine     | #2 | 6-7                               | 10-2               | 13-2               | 15-9               | 18-5               | 6-7                | 9-5                | 12-2               | 14-7               | 17-1              |
|                               | Southern pine     | #3 | 5-4                               | 7-11               | 10-1               | 11-11              | 14-2               | 4-11               | 7-4                | 9-4                | 11-0               | 13-1              |
|                               | Spruce-pine-fir   | SS | 6-5                               | 10-2               | 13-4               | 17-0               | 20-9               | 6-5                | 10-2               | 13-4               | 16-8               | 19-4              |
|                               | Spruce-pine-fir   | #1 | 6-4                               | 9-9                | 12-4               | 15-1               | 17-6               | 6-2                | 9-0                | 11-5               | 13-11              | 16-2              |
|                               | Spruce-pine-fir   | #2 | 6-4                               | 9-9                | 12-4               | 15-1               | 17-6               | 6-2                | 9-0                | 11-5               | 13-11              | 16-2              |
|                               | Spruce-pine-fir   | #3 | 5-0                               | 7-4                | 9-4                | 11-5               | 13-2               | 4-8                | 6-10               | 8-8                | 10-6               | 12-3              |
| 19.2                          | Douglas fir-larch | SS | 6-7                               | 10-4               | 13-7               | 17-4               | 20-6               | 6-7                | 10-4               | 13-5               | 16-5               | 19-0              |
|                               | Douglas fir-larch | #1 | 6-4                               | 9-6                | 12-0               | 14-8               | 17-1               | 6-0                | 8-10               | 11-2               | 13-7               | 15-9              |
|                               | Douglas fir-larch | #2 | 6-1                               | 8-11               | 11-3               | 13-9               | 15-11              | 5-7                | 8-3                | 10-5               | 12-9               | 14-9              |
|                               | Douglas fir-larch | #3 | 4-7                               | 6-9                | 8-6                | 10-5               | 12-1               | 4-3                | 6-3                | 7-11               | 9-7                | 11-2              |
|                               | Hem-fir           | SS | 6-2                               | 9-9                | 12-10              | 16-5               | 19-11              | 6-2                | 9-9                | 12-10              | 16-1               | 18-8              |
|                               | Hem-fir           | #1 | 6-1                               | 9-3                | 11-9               | 14-4               | 16-7               | 5-10               | 8-7                | 10-10              | 13-3               | 15-5              |
|                               | Hem-fir           | #2 | 5-9                               | 8-9                | 11-1               | 13-7               | 15-9               | 5-7                | 8-1                | 10-3               | 12-7               | 14-7              |
|                               | Hem-fir           | #3 | 4-7                               | 6-9                | 8-6                | 10-5               | 12-1               | 4-3                | 6-3                | 7-11               | 9-7                | 11-2              |
|                               | Southern pine     | SS | 6-5                               | 10-2               | 13-4               | 17-0               | 20-9               | 6-5                | 10-2               | 13-4               | 17-0               | 20-9              |
|                               | Southern pine     | #1 | 6-4                               | 9-11               | 13-1               | 16-0               | 19-1               | 6-4                | 9-11               | 12-5               | 14-10              | 17-8              |
|                               | Southern pine     | #2 | 6-2                               | 9-4                | 12-0               | 14-4               | 16-10              | 6-0                | 8-8                | 11-2               | 13-4               | 15-7              |
|                               | Southern pine     | #3 | 4-11                              | 7-3                | 9-2                | 10-10              | 12-11              | 4-6                | 6-8                | 8-6                | 10-1               | 12-0              |
|                               | Spruce-pine-fir   | SS | 6-1                               | 9-6                | 12-7               | 16-0               | 19-1               | 6-1                | 9-6                | 12-5               | 15-3               | 17-8              |
|                               | Spruce-pine-fir   | #1 | 5-11                              | 8-11               | 11-3               | 13-9               | 15-11              | 5-7                | 8-3                | 10-5               | 12-9               | 14-9              |
|                               | Spruce-pine-fir   | #2 | 5-11                              | 8-11               | 11-3               | 13-9               | 15-11              | 5-7                | 8-3                | 10-5               | 12-9               | 14-9              |
|                               | Spruce-pine-fir   | #3 | 4-7                               | 6-9                | 8-6                | 10-5               | 12-1               | 4-3                | 6-3                | 7-11               | 9-7                | 11-2              |

780 CMR TABLE 5802.5.1(6) - continued  
RAFTER SPANS FOR COMMON LUMBER SPECIES  
(Ground snow load=50 psf, ceiling attached to rafters, L/Δ = 240)

| RAFTER<br>SPACING<br>(inches) | SPECIES AND GRADE |  | DEAD LOAD = 10 psf                |                    |                    |                    |                    | DEAD LOAD = 20 psf |                    |                    |                    |                   |
|-------------------------------|-------------------|--|-----------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|-------------------|
|                               |                   |  | 2 × 4                             | 2 × 6              | 2 × 8              | 2 × 10             | 2 × 12             | 2 × 4              | 2 × 6              | 2 × 8              | 2 × 10             | 2 × 12            |
|                               |                   |  | Maximum rafter spans <sup>a</sup> |                    |                    |                    |                    |                    |                    |                    |                    |                   |
|                               |                   |  | (feet- in<br>ches)                | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet-<br>inches) |

THE MASSACHUSETTS STATE BUILDING CODE

|    |                   |    |      |      |       |       |       |      |      |      |       |       |
|----|-------------------|----|------|------|-------|-------|-------|------|------|------|-------|-------|
| 24 | Douglas fir-larch | SS | 6-1  | 9-7  | 12-7  | 15-10 | 18-4  | 6-1  | 9-6  | 12-0 | 14-8  | 17-0  |
|    | Douglas fir-larch | #1 | 5-10 | 8-6  | 10-9  | 13-2  | 15-3  | 5-5  | 7-10 | 10-0 | 12-2  | 14-1  |
|    | Douglas fir-larch | #2 | 5-5  | 7-11 | 10-1  | 12-4  | 14-3  | 5-0  | 7-4  | 9-4  | 11-5  | 13-2  |
|    | Douglas fir-larch | #3 | 4-1  | 6-0  | 7-7   | 9-4   | 10-9  | 3-10 | 5-7  | 7-1  | 8-7   | 10-0  |
|    | Hem-fir           | SS | 5-9  | 9-1  | 11-11 | 15-2  | 18-0  | 5-9  | 9-1  | 11-9 | 14-5  | 15-11 |
|    | Hem-fir           | #1 | 5-8  | 8-3  | 10-6  | 12-10 | 14-10 | 5-3  | 7-8  | 9-9  | 11-10 | 13-9  |
|    | Hem-fir           | #2 | 5-4  | 7-10 | 9-11  | 12-1  | 14-1  | 4-11 | 7-3  | 9-2  | 11-3  | 13-0  |
|    | Hem-fir           | #3 | 4-1  | 6-0  | 7-7   | 9-4   | 10-9  | 3-10 | 5-7  | 7-1  | 8-7   | 10-0  |
|    | Southern pine     | SS | 6-0  | 9-5  | 12-5  | 15-10 | 19-3  | 6-0  | 9-5  | 12-5 | 15-10 | 19-3  |
|    | Southern pine     | #1 | 5-10 | 9-3  | 12-0  | 14-4  | 17-1  | 5-10 | 8-10 | 11-2 | 13-0  | 15-9  |
|    | Southern pine     | #2 | 5-9  | 8-4  | 10-9  | 12-10 | 15-1  | 5-5  | 7-9  | 10-0 | 11-11 | 13-11 |
|    | Southern pine     | #3 | 4-4  | 6-5  | 8-3   | 9-9   | 11-7  | 4-1  | 6-0  | 7-7  | 9-0   | 10-8  |
|    | Spruce-pine-fir   | SS | 5-8  | 8-10 | 11-8  | 14-8  | 17-1  | 5-8  | 8-10 | 11-2 | 13-7  | 15-9  |
|    | Spruce-pine-fir   | #1 | 5-5  | 7-11 | 10-1  | 12-4  | 14-3  | 5-0  | 7-4  | 9-4  | 11-5  | 13-2  |
|    | Spruce-pine-fir   | #2 | 5-5  | 7-11 | 10-1  | 12-4  | 14-3  | 5-0  | 7-4  | 9-4  | 11-5  | 13-2  |
|    | Spruce-pine-fir   | #3 | 4-1  | 6-0  | 7-7   | 9-4   | 10-9  | 3-10 | 5-7  | 7-1  | 8-7   | 10-0  |

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m².

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

| $H_C/H_R$      | Rafter Span Adjustment<br>Factor |
|----------------|----------------------------------|
| 2/3 or greater | 0.50                             |
| 1/2            | 0.58                             |
| 1/3            | 0.67                             |
| 1/4            | 0.76                             |
| 1/5            | 0.83                             |
| 1/6            | 0.90                             |
| 1/7.5 and less | 1.00                             |

where:  $H_C$  = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.  $H_R$  = Height of roof ridge measured vertically above the top of the rafter support walls.

780 CMR TABLE 5802.5.1(7)  
RAFTER SPANS FOR 70 PSF GROUND SNOW LOAD  
(Ceiling not attached to rafters, L/Δ = 180)

| RAFTER<br>SPACING<br>(inches) | SPECIES AND GRADE |    | DEAD LOAD = 10 psf                |                    |                    |                    |                    | DEAD LOAD = 20 psf |                    |                    |                    |                |
|-------------------------------|-------------------|----|-----------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|----------------|
|                               |                   |    | 2 × 4                             | 2 × 6              | 2 × 8              | 2 × 10             | 2 × 12             | 2 × 4              | 2 × 6              | 2 × 8              | 2 × 10             | 2 × 12         |
|                               |                   |    | Maximum Rafter Spans <sup>a</sup> |                    |                    |                    |                    |                    |                    |                    |                    |                |
|                               |                   |    | (feet- in<br>ches)                | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- inches) |
| 12                            | Douglas fir-larch | SS | 7-7                               | 11-10              | 15-8               | 19-5               | 22-6               | 7-7                | 11-10              | 15-0               | 18-3               | 21-2           |
|                               | Douglas fir-larch | #1 | 7-1                               | 10-5               | 13-2               | 16-1               | 18-8               | 6-8                | 9-10               | 12-5               | 15-2               | 17-7           |
|                               | Douglas fir-larch | #2 | 6-8                               | 9-9                | 12-4               | 15-1               | 17-6               | 6-3                | 9-2                | 11-8               | 14-2               | 16-6           |
|                               | Douglas fir-larch | #3 | 5-0                               | 7-4                | 9-4                | 11-5               | 13-2               | 4-9                | 6-11               | 8-9                | 10-9               | 12-5           |
|                               | Hem-fir           | SS | 7-2                               | 11-3               | 14-9               | 18-10              | 22-1               | 7-2                | 11-3               | 14-8               | 18-0               | 20-10          |
|                               | Hem-fir           | #1 | 6-11                              | 10-2               | 12-10              | 15-8               | 18-2               | 6-6                | 9-7                | 12-1               | 14-10              | 17-2           |
|                               | Hem-fir           | #2 | 6-7                               | 9-7                | 12-2               | 14-10              | 17-3               | 6-2                | 9-1                | 11-5               | 14-0               | 16-3           |
|                               | Hem-fir           | #3 | 5-0                               | 7-4                | 9-4                | 11-5               | 13-2               | 4-9                | 6-11               | 8-9                | 10-9               | 12-5           |
|                               | Southern pine     | SS | 7-5                               | 11-8               | 15-4               | 19-7               | 23-10              | 7-5                | 11-8               | 15-4               | 19-7               | 23-10          |
|                               | Southern pine     | #1 | 7-3                               | 11-5               | 14-9               | 17-6               | 20-11              | 7-3                | 11-1               | 13-11              | 16-6               | 19-8           |
|                               | Southern pine     | #2 | 7-1                               | 10-2               | 13-2               | 15-9               | 18-5               | 6-8                | 9-7                | 12-5               | 14-10              | 17-5           |
|                               | Southern pine     | #3 | 5-4                               | 7-11               | 10-1               | 11-11              | 14-2               | 5-1                | 7-5                | 9-6                | 11-3               | 13-4           |
|                               | Spruce-pine-fir   | SS | 7-0                               | 11-0               | 14-6               | 18-0               | 20-11              | 7-0                | 11-10              | 13-11              | 17-0               | 19-8           |
|                               | Spruce-pine-fir   | #1 | 6-8                               | 9-9                | 12-4               | 15-1               | 17-6               | 6-3                | 9-2                | 11-8               | 14-2               | 16-6           |
|                               | Spruce-pine-fir   | #2 | 6-8                               | 9-9                | 12-4               | 15-1               | 17-6               | 6-3                | 9-2                | 11-8               | 14-2               | 16-6           |
|                               | Spruce-pine-fir   | #3 | 5-0                               | 7-4                | 9-4                | 11-5               | 13-2               | 4-9                | 6-11               | 8-9                | 10-9               | 12-5           |
| 16                            | Douglas fir-larch | SS | 6-10                              | 10-9               | 13-9               | 16-10              | 19-6               | 6-10               | 10-3               | 13-0               | 15-10              | 18-4           |
|                               | Douglas fir-larch | #1 | 6-2                               | 9-0                | 11-5               | 13-11              | 16-2               | 5-10               | 8-6                | 10-9               | 13-2               | 15-3           |
|                               | Douglas fir-larch | #2 | 5-9                               | 8-5                | 10-8               | 13-1               | 15-2               | 5-5                | 7-11               | 10-1               | 12-4               | 14-3           |
|                               | Douglas fir-larch | #3 | 4-4                               | 6-4                | 8-1                | 9-10               | 11-5               | 4-1                | 6-0                | 7-7                | 9-4                | 10-9           |
|                               | Hem-fir           | SS | 6-6                               | 10-2               | 13-5               | 16-6               | 19-2               | 6-6                | 10-1               | 12-9               | 15-7               | 18-0           |
|                               | Hem-fir           | #1 | 6-0                               | 8-9                | 11-2               | 13-7               | 15-9               | 5-8                | 8-3                | 10-6               | 12-10              | 14-10          |
|                               | Hem-fir           | #2 | 5-8                               | 8-4                | 10-6               | 12-10              | 14-11              | 5-4                | 7-10               | 9-11               | 12-1               | 14-1           |
|                               | Hem-fir           | #3 | 4-4                               | 6-4                | 8-1                | 9-10               | 11-5               | 4-1                | 6-0                | 7-7                | 9-4                | 10-9           |
|                               | Southern pine     | SS | 6-9                               | 10-7               | 14-0               | 17-10              | 21-8               | 6-9                | 10-7               | 14-0               | 17-10              | 21-0           |
|                               | Southern pine     | #1 | 6-7                               | 10-2               | 12-9               | 15-2               | 18-1               | 6-5                | 9-7                | 12-0               | 14-4               | 17-1           |
|                               | Southern pine     | #2 | 6-2                               | 8-10               | 11-5               | 13-7               | 16-0               | 5-10               | 8-4                | 10-9               | 12-10              | 15-1           |
|                               | Southern pine     | #3 | 4-8                               | 6-10               | 8-9                | 10-4               | 12-3               | 4-4                | 6-5                | 8-3                | 9-9                | 11-7           |
|                               | Spruce-pine-fir   | SS | 6-4                               | 10-0               | 12-9               | 15-7               | 18-1               | 6-4                | 9-6                | 12-0               | 14-8               | 17-1           |
|                               | Spruce-pine-fir   | #1 | 5-9                               | 8-5                | 10-8               | 13-1               | 15-2               | 5-5                | 7-11               | 10-1               | 12-4               | 14-3           |
|                               | Spruce-pine-fir   | #2 | 5-9                               | 8-5                | 10-8               | 13-1               | 15-2               | 5-5                | 7-11               | 10-1               | 12-4               | 14-3           |
|                               | Spruce-pine-fir   | #3 | 4-4                               | 6-4                | 8-1                | 9-10               | 11-5               | 4-1                | 6-0                | 7-7                | 9-4                | 10-9           |
| 19.2                          | Douglas fir-larch | SS | 6-5                               | 9-11               | 12-7               | 15-4               | 17-9               | 6-5                | 9-4                | 11-10              | 14-5               | 16-9           |
|                               | Douglas fir-larch | #1 | 5-7                               | 8-3                | 10-5               | 12-9               | 14-9               | 5-4                | 7-9                | 9-10               | 12-0               | 13-11          |
|                               | Douglas fir-larch | #2 | 5-3                               | 7-8                | 9-9                | 11-11              | 13-10              | 5-0                | 7-3                | 9-2                | 11-3               | 13-0           |
|                               | Douglas fir-larch | #3 | 4-0                               | 5-10               | 7-4                | 9-0                | 10-5               | 3-9                | 5-6                | 6-11               | 8-6                | 9-10           |
|                               | Hem-fir           | SS | 6-1                               | 9-7                | 12-4               | 15-1               | 17-4               | 6-1                | 9-2                | 11-8               | 14-2               | 15-5           |
|                               | Hem-fir           | #1 | 5-6                               | 8-0                | 10-2               | 12-5               | 14-5               | 5-2                | 7-7                | 9-7                | 11-8               | 13-7           |
|                               | Hem-fir           | #2 | 5-2                               | 7-7                | 9-7                | 11-9               | 13-7               | 4-11               | 7-2                | 9-1                | 11-1               | 12-10          |
|                               | Hem-fir           | #3 | 4-0                               | 5-10               | 7-4                | 9-0                | 10-5               | 3-9                | 5-6                | 6-11               | 8-6                | 9-10           |
|                               | Southern pine     | SS | 6-4                               | 10-0               | 13-2               | 16-9               | 20-4               | 6-4                | 10-0               | 13-2               | 16-5               | 19-2           |
|                               | Southern pine     | #1 | 6-3                               | 9-3                | 11-8               | 13-10              | 16-6               | 5-11               | 8-9                | 11-0               | 13-1               | 15-7           |
|                               | Southern pine     | #2 | 5-7                               | 8-1                | 10-5               | 12-5               | 14-7               | 5-4                | 7-7                | 9-10               | 11-9               | 13-9           |
|                               | Southern pine     | #3 | 4-3                               | 6-3                | 8-0                | 9-5                | 11-2               | 4-0                | 5-11               | 7-6                | 8-10               | 10-7           |
|                               | Spruce-pine-fir   | SS | 6-0                               | 9-2                | 11-8               | 14-3               | 16-6               | 5-11               | 8-8                | 11-10              | 13-5               | 15-7           |
|                               | Spruce-pine-fir   | #1 | 5-3                               | 7-8                | 9-9                | 11-11              | 13-10              | 5-0                | 7-3                | 9-2                | 11-3               | 13-0           |
|                               | Spruce-pine-fir   | #2 | 5-3                               | 7-8                | 9-9                | 11-11              | 13-10              | 5-0                | 7-3                | 9-2                | 11-3               | 13-0           |
|                               | Spruce-pine-fir   | #3 | 4-0                               | 5-10               | 7-4                | 9-0                | 10-5               | 3-9                | 5-6                | 6-11               | 8-6                | 9-10           |

780 CMR TABLE 5802.5.1(7) - continued  
RAFTER SPANS FOR 70 PSF GROUND SNOW LOAD  
(Ceiling not attached to rafters, L/Δ = 180)

| RAFTER<br>SPACING<br>(inches) | SPECIES AND GRADE |  | DEAD LOAD = 10 psf                |                    |                    |                    |                    | DEAD LOAD = 20 psf |                    |                    |                    |                |
|-------------------------------|-------------------|--|-----------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|----------------|
|                               |                   |  | 2 × 4                             | 2 × 6              | 2 × 8              | 2 × 10             | 2 × 12             | 2 × 4              | 2 × 6              | 2 × 8              | 2 × 10             | 2 × 12         |
|                               |                   |  | Maximum Rafter Spans <sup>a</sup> |                    |                    |                    |                    |                    |                    |                    |                    |                |
|                               |                   |  | (feet- in<br>ches)                | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- in<br>ches) | (feet- inches) |

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THE MASSACHUSETTS STATE BUILDING CODE

|    |                   |    |      |      |       |      |       |      |      |      |       |       |
|----|-------------------|----|------|------|-------|------|-------|------|------|------|-------|-------|
| 24 | Douglas fir-larch | SS | 6-0  | 8-10 | 11-3  | 13-9 | 15-11 | 5-9  | 8-4  | 10-7 | 12-11 | 15-0  |
|    | Douglas fir-larch | #1 | 5-0  | 7-4  | 9-4   | 11-5 | 13-2  | 4-9  | 6-11 | 8-9  | 10-9  | 12-5  |
|    | Douglas fir-larch | #2 | 4-8  | 6-11 | 8-9   | 10-8 | 12-4  | 4-5  | 6-6  | 8-3  | 10-0  | 11-8  |
|    | Douglas fir-larch | #3 | 3-7  | 5-2  | 6-7   | 8-1  | 9-4   | 3-4  | 4-11 | 6-3  | 7-7   | 8-10  |
|    | Hem-fir           | SS | 5-8  | 8-8  | 11-10 | 13-6 | 13-11 | 5-7  | 8-3  | 10-5 | 12-4  | 12-4  |
|    | Hem-fir           | #1 | 4-11 | 7-2  | 9-1   | 11-1 | 12-10 | 4-7  | 6-9  | 8-7  | 10-6  | 12-2  |
|    | Hem-fir           | #2 | 4-8  | 6-9  | 8-7   | 10-6 | 12-2  | 4-4  | 6-5  | 8-1  | 9-11  | 11-6  |
|    | Hem-fir           | #3 | 3-7  | 5-2  | 6-7   | 8-1  | 9-4   | 3-4  | 4-11 | 6-3  | 7-7   | 8-10  |
|    | Southern pine     | SS | 5-11 | 9-3  | 12-2  | 15-7 | 18-2  | 5-11 | 9-3  | 12-2 | 14-8  | 17-2  |
|    | Southern pine     | #1 | 5-7  | 8-3  | 10-5  | 12-5 | 14-9  | 5-3  | 7-10 | 9-10 | 11-8  | 13-11 |
|    | Southern pine     | #2 | 5-0  | 7-3  | 9-4   | 11-1 | 13-0  | 4-9  | 6-10 | 8-9  | 10-6  | 12-4  |
|    | Southern pine     | #3 | 3-9  | 5-7  | 7-1   | 8-5  | 10-0  | 3-7  | 5-3  | 6-9  | 7-11  | 9-5   |
|    | Spruce-pine-fir   | SS | 5-6  | 8-3  | 10-5  | 12-9 | 14-9  | 5-4  | 7-9  | 9-10 | 12-0  | 12-11 |
|    | Spruce-pine-fir   | #1 | 4-8  | 6-11 | 8-9   | 10-8 | 12-4  | 4-5  | 6-6  | 8-3  | 10-0  | 11-8  |
|    | Spruce-pine-fir   | #2 | 4-8  | 6-11 | 8-9   | 10-8 | 12-4  | 4-5  | 6-6  | 8-3  | 10-0  | 11-8  |
|    | Spruce-pine-fir   | #3 | 3-7  | 5-2  | 6-7   | 8-1  | 9-4   | 3-4  | 4-11 | 6-3  | 7-7   | 8-10  |

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m<sup>2</sup>.

a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

| $H_C/H_R$      | Rafter Span Adjustment<br>Factor |
|----------------|----------------------------------|
| 2/3 or greater | 0.50                             |
| 1/2            | 0.58                             |
| 1/3            | 0.67                             |
| 1/4            | 0.76                             |
| 1/5            | 0.83                             |
| 1/6            | 0.90                             |
| 1/7.5 and less | 1.00                             |

where:  $H_C$  = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.  $H_R$  = Height of roof ridge measured vertically above the top of the rafter support walls.

780 CMR TABLE 5802.5.1(8)  
RAFTER SPANS FOR 70 PSF GROUND SNOW LOAD  
(Ceiling attached to rafters, L/Δ = 240)

| RAFTER<br>SPACING<br>(inches) | SPECIES AND GRADE |    | DEAD LOAD = 10 psf                |                     |                     |                     |                     | DEAD LOAD = 20 psf  |                     |                     |                     |                     |
|-------------------------------|-------------------|----|-----------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|                               |                   |    | 2 × 4                             | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              | 2 × 4               | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              |
|                               |                   |    | Maximum rafter spans <sup>a</sup> |                     |                     |                     |                     |                     |                     |                     |                     |                     |
|                               |                   |    | (feet - i<br>nches)               | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) |
| 12                            | Douglas fir-larch | SS | 6-10                              | 10-9                | 14-3                | 18-2                | 22-1                | 6-10                | 10-9                | 14-3                | 18-2                | 21-2                |
|                               | Douglas fir-larch | #1 | 6-7                               | 10-5                | 13-2                | 16-1                | 18-8                | 6-7                 | 9-10                | 12-5                | 15-2                | 17-7                |
|                               | Douglas fir-larch | #2 | 6-6                               | 9-9                 | 12-4                | 15-1                | 17-6                | 6-3                 | 9-2                 | 11-8                | 14-2                | 16-6                |
|                               | Douglas fir-larch | #3 | 5-0                               | 7-4                 | 9-4                 | 11-5                | 13-2                | 4-9                 | 6-11                | 8-9                 | 10-9                | 12-5                |
|                               | Hem-fir           | SS | 6-6                               | 10-2                | 13-5                | 17-2                | 20-10               | 6-6                 | 10-2                | 13-5                | 17-2                | 20-10               |
|                               | Hem-fir           | #1 | 6-4                               | 10-0                | 12-10               | 15-8                | 18-2                | 6-4                 | 9-7                 | 12-1                | 14-10               | 17-2                |
|                               | Hem-fir           | #2 | 6-1                               | 9-6                 | 12-2                | 14-10               | 17-3                | 6-1                 | 9-1                 | 11-5                | 14-0                | 16-3                |
|                               | Hem-fir           | #3 | 5-0                               | 7-4                 | 9-4                 | 11-5                | 13-2                | 4-9                 | 6-11                | 8-9                 | 10-9                | 12-5                |
|                               | Southern pine     | SS | 6-9                               | 10-7                | 14-0                | 17-10               | 21-8                | 6-9                 | 10-7                | 14-0                | 17-10               | 21-8                |
|                               | Southern pine     | #1 | 6-7                               | 10-5                | 13-8                | 17-6                | 20-11               | 6-7                 | 10-5                | 13-8                | 16-6                | 19-8                |
|                               | Southern pine     | #2 | 6-6                               | 10-2                | 13-2                | 15-9                | 18-5                | 6-6                 | 9-7                 | 12-5                | 14-10               | 17-5                |
|                               | Southern pine     | #3 | 5-4                               | 7-11                | 10-1                | 11-11               | 14-2                | 5-1                 | 7-5                 | 9-6                 | 11-3                | 13-4                |
|                               | Spruce-pine-fir   | SS | 6-4                               | 10-0                | 13-2                | 16-9                | 20-5                | 6-4                 | 10-0                | 13-2                | 16-9                | 19-8                |
|                               | Spruce-pine-fir   | #1 | 6-2                               | 9-9                 | 12-4                | 15-1                | 17-6                | 6-2                 | 9-2                 | 11-8                | 14-2                | 16-6                |
|                               | Spruce-pine-fir   | #2 | 6-2                               | 9-9                 | 12-4                | 15-1                | 17-6                | 6-2                 | 9-2                 | 11-8                | 14-2                | 16-6                |
|                               | Spruce-pine-fir   | #3 | 5-0                               | 7-4                 | 9-4                 | 11-5                | 13-2                | 4-9                 | 6-11                | 8-9                 | 10-9                | 12-5                |
| 16                            | Douglas fir-larch | SS | 6-3                               | 9-10                | 12-11               | 16-6                | 19-6                | 6-3                 | 9-10                | 12-11               | 15-10               | 18-4                |
|                               | Douglas fir-larch | #1 | 6-0                               | 9-0                 | 11-5                | 13-11               | 16-2                | 5-10                | 8-6                 | 10-9                | 13-2                | 15-3                |
|                               | Douglas fir-larch | #2 | 5-9                               | 8-5                 | 10-8                | 13-1                | 15-2                | 5-5                 | 7-11                | 10-1                | 12-4                | 14-3                |
|                               | Douglas fir-larch | #3 | 4-4                               | 6-4                 | 8-1                 | 9-10                | 11-5                | 4-1                 | 6-0                 | 7-7                 | 9-4                 | 10-9                |
|                               | Hem-fir           | SS | 5-11                              | 9-3                 | 12-2                | 15-7                | 18-11               | 5-11                | 9-3                 | 12-2                | 15-7                | 18-0                |
|                               | Hem-fir           | #1 | 5-9                               | 8-9                 | 11-2                | 13-7                | 15-9                | 5-8                 | 8-3                 | 10-6                | 12-10               | 14-10               |
|                               | Hem-fir           | #2 | 5-6                               | 8-4                 | 10-6                | 12-10               | 14-11               | 5-4                 | 7-10                | 9-11                | 12-1                | 14-1                |
|                               | Hem-fir           | #3 | 4-4                               | 6-4                 | 8-1                 | 9-10                | 11-5                | 4-1                 | 6-0                 | 7-7                 | 9-4                 | 10-9                |
|                               | Southern pine     | SS | 6-1                               | 9-7                 | 12-8                | 16-2                | 19-8                | 6-1                 | 9-7                 | 12-8                | 16-2                | 19-8                |
|                               | Southern pine     | #1 | 6-0                               | 9-5                 | 12-5                | 15-2                | 18-1                | 6-0                 | 9-5                 | 12-0                | 14-4                | 17-1                |
|                               | Southern pine     | #2 | 5-11                              | 8-10                | 11-5                | 13-7                | 16-0                | 5-10                | 8-4                 | 10-9                | 12-10               | 15-1                |
|                               | Southern pine     | #3 | 4-8                               | 6-10                | 8-9                 | 10-4                | 12-3                | 4-4                 | 6-5                 | 8-3                 | 9-9                 | 11-7                |
|                               | Spruce-pine-fir   | SS | 5-9                               | 9-1                 | 11-11               | 15-3                | 18-1                | 5-9                 | 9-1                 | 11-11               | 14-8                | 17-1                |
|                               | Spruce-pine-fir   | #1 | 5-8                               | 8-5                 | 10-8                | 13-1                | 15-2                | 5-5                 | 7-11                | 10-1                | 12-4                | 14-3                |
|                               | Spruce-pine-fir   | #2 | 5-8                               | 8-5                 | 10-8                | 13-1                | 15-2                | 5-5                 | 7-11                | 10-1                | 12-4                | 14-3                |
|                               | Spruce-pine-fir   | #3 | 4-4                               | 6-4                 | 8-1                 | 9-10                | 11-5                | 4-1                 | 6-0                 | 7-7                 | 9-4                 | 10-9                |
| 19.2                          | Douglas fir-larch | SS | 5-10                              | 9-3                 | 12-2                | 15-4                | 17-9                | 5-10                | 9-3                 | 11-10               | 14-5                | 16-9                |
|                               | Douglas fir-larch | #1 | 5-7                               | 8-3                 | 10-5                | 12-9                | 14-9                | 5-4                 | 7-9                 | 9-10                | 12-0                | 13-11               |
|                               | Douglas fir-larch | #2 | 5-3                               | 7-8                 | 9-9                 | 11-11               | 13-10               | 5-0                 | 7-3                 | 9-2                 | 11-3                | 13-0                |
|                               | Douglas fir-larch | #3 | 4-0                               | 5-10                | 7-4                 | 9-0                 | 10-5                | 3-9                 | 5-6                 | 6-11                | 8-6                 | 9-10                |
|                               | Hem-fir           | SS | 5-6                               | 8-8                 | 11-6                | 14-8                | 17-4                | 5-6                 | 8-8                 | 11-6                | 14-2                | 15-5                |
|                               | Hem-fir           | #1 | 5-5                               | 8-0                 | 10-2                | 12-5                | 14-5                | 5-2                 | 7-7                 | 9-7                 | 11-8                | 13-7                |
|                               | Hem-fir           | #2 | 5-2                               | 7-7                 | 9-7                 | 11-9                | 13-7                | 4-11                | 7-2                 | 9-1                 | 11-1                | 12-10               |
|                               | Hem-fir           | #3 | 4-0                               | 5-10                | 7-4                 | 9-0                 | 10-5                | 3-9                 | 5-6                 | 6-11                | 8-6                 | 9-10                |
|                               | Southern pine     | SS | 5-9                               | 9-1                 | 11-11               | 15-3                | 18-6                | 5-9                 | 9-1                 | 11-11               | 15-3                | 18-6                |
|                               | Southern pine     | #1 | 5-8                               | 8-11                | 11-8                | 13-10               | 16-6                | 5-8                 | 8-9                 | 11-0                | 13-1                | 15-7                |
|                               | Southern pine     | #2 | 5-6                               | 8-1                 | 10-5                | 12-5                | 14-7                | 5-4                 | 7-7                 | 9-10                | 11-9                | 13-9                |
|                               | Southern pine     | #3 | 4-3                               | 6-3                 | 8-0                 | 9-5                 | 11-2                | 4-0                 | 5-11                | 7-6                 | 8-10                | 10-7                |
|                               | Spruce-pine-fir   | SS | 5-5                               | 8-6                 | 11-3                | 14-3                | 16-6                | 5-5                 | 8-6                 | 11-0                | 13-5                | 15-7                |
|                               | Spruce-pine-fir   | #1 | 5-3                               | 7-8                 | 9-9                 | 11-11               | 13-10               | 5-0                 | 7-3                 | 9-2                 | 11-3                | 13-0                |
|                               | Spruce-pine-fir   | #2 | 5-3                               | 7-8                 | 9-9                 | 11-11               | 13-10               | 5-0                 | 7-3                 | 9-2                 | 11-3                | 13-0                |
|                               | Spruce-pine-fir   | #3 | 4-0                               | 5-10                | 7-4                 | 9-0                 | 10-5                | 3-9                 | 5-6                 | 6-11                | 8-6                 | 9-10                |

780 CMR TABLE 5802.5.1(8) - continued  
RAFTER SPANS FOR 70 PSF GROUND SNOW LOAD  
(Ceiling attached to rafters, L/Δ = 240)

| RAFTER<br>SPACING<br>(inches) | SPECIES AND GRADE |  | DEAD LOAD = 10 psf                |                     |                     |                     |                     | DEAD LOAD = 20 psf  |                     |                     |                     |                     |
|-------------------------------|-------------------|--|-----------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
|                               |                   |  | 2 × 4                             | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              | 2 × 4               | 2 × 6               | 2 × 8               | 2 × 10              | 2 × 12              |
|                               |                   |  | Maximum rafter spans <sup>a</sup> |                     |                     |                     |                     |                     |                     |                     |                     |                     |
|                               |                   |  | (feet - i<br>nches)               | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) | (feet - i<br>nches) |

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|    |                   |    |      |      |      |      |       |     |      |      |       |       |
|----|-------------------|----|------|------|------|------|-------|-----|------|------|-------|-------|
| 24 | Douglas fir-larch | SS | 5-5  | 8-7  | 11-3 | 13-9 | 15-11 | 5-5 | 8-4  | 10-7 | 12-11 | 15-0  |
|    | Douglas fir-larch | #1 | 5-0  | 7-4  | 9-4  | 11-5 | 13-2  | 4-9 | 6-11 | 8-9  | 10-9  | 12-5  |
|    | Douglas fir-larch | #2 | 4-8  | 6-11 | 8-9  | 10-8 | 12-4  | 4-5 | 6-6  | 8-3  | 10-0  | 11-8  |
|    | Douglas fir-larch | #3 | 3-7  | 5-2  | 6-7  | 8-1  | 9-4   | 3-4 | 4-11 | 6-3  | 7-7   | 8-10  |
|    | Hem-fir           | SS | 5-2  | 8-1  | 10-8 | 13-6 | 13-11 | 5-2 | 8-1  | 10-5 | 12-4  | 12-4  |
|    | Hem-fir           | #1 | 4-11 | 7-2  | 9-1  | 11-1 | 12-10 | 4-7 | 6-9  | 8-7  | 10-6  | 12-2  |
|    | Hem-fir           | #2 | 4-8  | 6-9  | 8-7  | 10-6 | 12-2  | 4-4 | 6-5  | 8-1  | 9-11  | 11-6  |
|    | Hem-fir           | #3 | 3-7  | 5-2  | 6-7  | 8-1  | 9-4   | 3-4 | 4-11 | 6-3  | 7-7   | 8-10  |
|    | Southern pine     | SS | 5-4  | 8-5  | 11-1 | 14-2 | 17-2  | 5-4 | 8-5  | 11-1 | 14-2  | 17-2  |
|    | Southern pine     | #1 | 5-3  | 8-3  | 10-5 | 12-5 | 14-9  | 5-3 | 7-10 | 9-10 | 11-8  | 13-11 |
|    | Southern pine     | #2 | 5-0  | 7-3  | 9-4  | 11-1 | 13-0  | 4-9 | 6-10 | 8-9  | 10-6  | 12-4  |
|    | Southern pine     | #3 | 3-9  | 5-7  | 7-1  | 8-5  | 10-0  | 3-7 | 5-3  | 6-9  | 7-11  | 9-5   |
|    | Spruce-pine-fir   | SS | 5-0  | 7-11 | 10-5 | 12-9 | 14-9  | 5-0 | 7-9  | 9-10 | 12-0  | 12-11 |
|    | Spruce-pine-fir   | #1 | 4-8  | 6-11 | 8-9  | 10-8 | 12-4  | 4-5 | 6-6  | 8-3  | 10-0  | 11-8  |
|    | Spruce-pine-fir   | #2 | 4-8  | 6-11 | 8-9  | 10-8 | 12-4  | 4-5 | 6-6  | 8-3  | 10-0  | 11-8  |
|    | Spruce-pine-fir   | #3 | 3-7  | 5-2  | 6-7  | 8-1  | 9-4   | 3-4 | 4-11 | 6-3  | 7-7   | 8-10  |

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m<sup>2</sup>.

a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

| $H_C/H_R$      | Rafter Span Adjustment<br>Factor |
|----------------|----------------------------------|
| 2/3 or greater | 0.50                             |
| 1/2            | 0.58                             |
| 1/3            | 0.67                             |
| 1/4            | 0.76                             |
| 1/5            | 0.83                             |
| 1/6            | 0.90                             |
| 1/7.5 and less | 1.00                             |

where:  $H_C$  = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.  
 $H_R$  = Height of roof ridge measured vertically above the top of the rafter support walls.



780 CMR TABLE 5802.5.1(9)  
RAFTER/CEILING JOIST HEEL JOINT CONNECTIONS<sup>a,b,c,d,e,f</sup>

| RAFTER<br>SLOPE | RAFTER<br>SPACING<br>(inches) | GROUND SNOW LOAD (psf)   |    |    |    |    |    |    |    |    |    |    |    |
|-----------------|-------------------------------|--|----|----|----|----|----|----|----|----|----|----|----|
|                 |                               | 30   |    |    |    | 50 |    |    |    | 70 |    |    |    |
|                 |                               | Roof span (feet)   |    |    |    |    |    |    |    |    |    |    |    |
|                 |                               | 12   | 20 | 28 | 36 | 12 | 20 | 28 | 36 | 12 | 20 | 28 | 36 |
|                 |                               | Required number of 16d common nails <sup>a,b</sup> per heel joint splices <sup>c,d,e,f</sup> |    |    |    |    |    |    |    |    |    |    |    |
| 3:12            | 12                            | 4  | 6  | 8  | 11 | 5  | 8  | 12 | 15 | 6  | 11 | 15 | 20 |
|                 | 16                            | 5  | 8  | 11 | 14 | 6  | 11 | 15 | 20 | 8  | 14 | 20 | 26 |
|                 | 24                            | 7  | 11 | 16 | 21 | 9  | 16 | 23 | 30 | 12 | 21 | 30 | 39 |
| 4:12            | 12                            | 3  | 5  | 6  | 8  | 4  | 6  | 9  | 11 | 5  | 8  | 12 | 15 |
|                 | 16                            | 4  | 6  | 8  | 11 | 5  | 8  | 12 | 15 | 6  | 11 | 15 | 20 |
|                 | 24                            | 5  | 9  | 12 | 16 | 7  | 12 | 17 | 22 | 9  | 16 | 23 | 29 |
| 5:12            | 12                            | 3  | 4  | 5  | 7  | 3  | 5  | 7  | 9  | 4  | 7  | 9  | 12 |
|                 | 16                            | 3  | 5  | 7  | 9  | 4  | 7  | 9  | 12 | 5  | 9  | 12 | 16 |
|                 | 24                            | 4  | 7  | 10 | 13 | 6  | 10 | 14 | 18 | 7  | 13 | 18 | 23 |
| 7:12            | 12                            | 3  | 3  | 4  | 5  | 3  | 4  | 5  | 7  | 3  | 5  | 7  | 9  |
|                 | 16                            | 3  | 4  | 5  | 6  | 3  | 5  | 7  | 9  | 4  | 6  | 9  | 11 |
|                 | 24                            | 3  | 5  | 7  | 9  | 4  | 7  | 10 | 13 | 5  | 9  | 13 | 17 |
| 9:12            | 12                            | 3  | 3  | 3  | 4  | 3  | 3  | 4  | 5  | 3  | 4  | 5  | 7  |
|                 | 16                            | 3  | 3  | 4  | 5  | 3  | 4  | 5  | 7  | 3  | 5  | 7  | 9  |
|                 | 24                            | 3  | 4  | 6  | 7  | 3  | 6  | 8  | 10 | 4  | 7  | 10 | 13 |
| 12:12           | 12                            | 3  | 3  | 3  | 3  | 3  | 3  | 3  | 4  | 3  | 3  | 4  | 5  |
|                 | 16                            | 3  | 3  | 3  | 4  | 3  | 3  | 4  | 5  | 3  | 4  | 5  | 7  |
|                 | 24                            | 3  | 3  | 4  | 6  | 3  | 4  | 6  | 8  | 3  | 6  | 8  | 10 |

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m<sup>2</sup>.

a. 40d box nails shall be permitted to be substituted for 16d common nails.

b. Nailing requirements shall be permitted to be reduced 25% if nails are clinched.

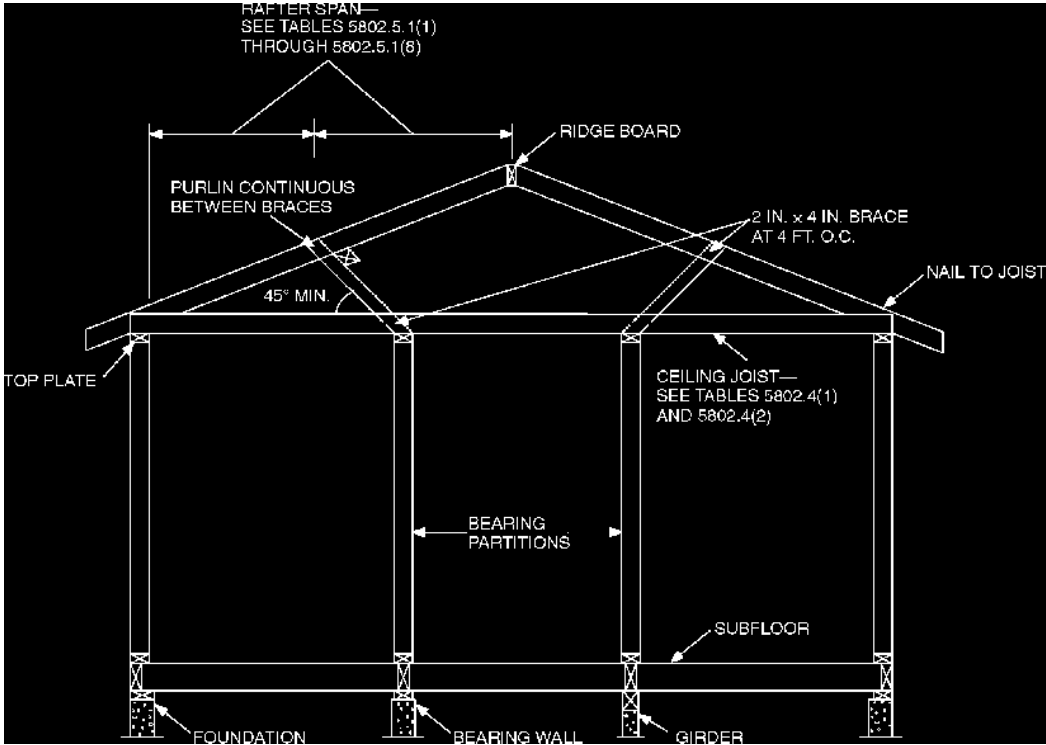
c. Heel joint connections are not required when the ridge is supported by a load-bearing wall, header or ridge beam.

d. When intermediate support of the rafter is provided by vertical struts or purlins to a load bearing wall, the tabulated heel joint connection requirements shall be permitted to be reduced proportionally to the reduction in span.

e. Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.

f. When rafter ties are substituted for ceiling joists, the heel joint connection requirement shall be taken as the tabulated heel joint connection requirement for \_ of the actual rafter-slope.

780 CMR FIGURE 5802.5.1  
BRACED RAFTER CONSTRUCTION



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.018 rad.  
**NOTE:** Where ceiling joints run perpendicular to the rafters, rafter ties shall be nailed to the rafter near the plate line and spaced not more than four feet on center.

780CMR TABLE 5802.11  
REQUIRED STRENGTH OF TRUSS OR RAFTER CONNECTIONS  
TO RESIST WIND UPLIFT FORCES<sup>a,b,c,e,f</sup>  
(Pounds per connection)

| BASIC WIND SPEED | ROOF SPAN (feet) |      |      |      |      |      |      | OVERHANGS <sup>d</sup><br>(pounds/feet) |
|------------------|------------------|------|------|------|------|------|------|---|
|                  | 12               | 20   | 24   | 28   | 32   | 36   | 40   |   |
| 85               | -72              | -120 | -145 | -169 | -193 | -217 | -241 | -38.55                                  |
| 90               | -91              | -151 | -181 | -212 | -242 | -272 | -302 | -43.22                                  |
| 100              | -131             | -218 | -262 | -305 | -349 | -393 | -436 | -53.36                                  |
| 110              | -175             | -292 | -351 | -409 | -467 | -526 | -584 | -64.56                                  |

- For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 mph = 1.61 km/hr, 1 pound/foot = 14.5939 N/m, 1 pound = 0.454 kg.
- a. The uplift connection requirements are based on a 30 foot mean roof height located in Exposure B. For Exposures C and D and for other mean roof heights, multiply the above loads by the Adjustment Coefficients in 780 CMR Table 5301.2(3).
  - b. The uplift connection requirements are based on the framing being spaced 24 inches on center. Multiply by 0.67 for framing spaced 16 inches on center and multiply by 0.5 for framing spaced 12 inches on center.
  - c. The uplift connection requirements include an allowance for ten pounds of dead load.
  - d. The uplift connection requirements do not account for the effects of overhangs. The magnitude of the above loads shall be increased by adding the overhang loads found in the table. The overhang loads are also based on framing spaced 24 inches on center. The overhang loads given shall be multiplied by the overhang projection and added to the roof uplift value in the table.
  - e. The uplift connection requirements are based upon wind loading on end zones as defined in Section M1609.6 of the *International Building Code*. Connection loads for connections located a distance of 20% of the least horizontal dimension of the building from the corner of the building are permitted to be reduced by multiplying the table connection value by 0.7 and multiplying the overhang load by 0.8.
  - f. For wall-to-wall and wall-to-foundation connections, the capacity of the uplift connector is permitted to be reduced by 100 pounds for each full wall above. (For example, if a 600-pound rated connector is used on the roof framing, a 500-pound rated connector is permitted at the next floor level down.)

**5802.10.5 Truss to Wall Connection.** Trusses shall be connected to wall plates by the use of approved connectors having a resistance to uplift of not less than 175 pounds (79.45 kg.) and shall be installed in accordance with the manufacturer’s specifications. For roof assemblies subject to wind uplift pressures of 20 pounds per square foot (0.958 kN/m<sup>2</sup>) or greater, as established in 780 CMR Table 5301.2(2), adjusted for height and exposure per 780 CMR Table 5301.2(3), *see* 780 CMR 5802.11.

**5802.11 Roof tie-down.**

**5802.11.1 Uplift Resistance.** Roof assemblies which are subject to wind uplift pressures of 20 pounds per square foot (0.958 kN/m<sup>2</sup>) or greater shall have roof rafters or trusses attached to their supporting wall assemblies by connections capable of providing the resistance required in 780 CMR Table 5802.11. Wind uplift pressures shall be determined using an effective wind area of 100 square feet (9.3 m<sup>2</sup>) and *the applicable wind zone* in 780 CMR Table 5301.2(2), as adjusted for height and exposure per 780 CMR Table 5301.2(3).

A continuous load path shall be provided to transmit the uplift forces from the rafter or truss ties to the foundation.

**780 CMR 5803 ROOF SHEATHING**

**5803.1 Lumber Sheathing.** Allowable spans for lumber used as roof sheathing shall conform to 780 CMR Table 5803.1. Spaced lumber sheathing for wood shingle and shake roofing shall conform to the requirements of 780 CMR 5905.7 and 5905.8.

**780 CMR TABLE 5803.1  
MINIMUM THICKNESS OF  
LUMBER ROOF SHEATHING**

| RAFTER OR BEAM<br>SPACING (inches) | MINIMUM NET<br>THICKNESS (inches) |
|------------------------------------|-----------------------------------|
| 24                                 | 1½T & G                           |
| 48 <sup>a</sup>                    |                                   |
| 60 <sup>b</sup>                    |                                   |
| 72 <sup>c</sup>                    |                                   |

For SI: 1 inch = 25.4 mm.  
a. Minimum 270 *F<sub>b</sub>*, 340,000 *E*.  
b. Minimum 420 *F<sub>b</sub>*, 660,000 *E*.  
c. Minimum 600*F<sub>b</sub>*, 1,150,000*E*.

**5803.2 Wood Structural Panel Sheathing.**

**5803.2.1 Identification and Grade.** Wood structural panels shall conform to DOC PS 1, DOC PS 2 or, when manufactured in Canada, CSA 0437, and shall be identified by grade mark or certificate of inspection issued by an approved agency. Wood structural panels shall

comply with the grades specified in 780 CMR Table 5503.2.1.1(1).

**5803.2.1.1 Exposure Durability.** All wood structural panels, when designed to be permanently exposed in outdoor applications, shall be of an exterior exposure durability. Wood structural panel roof sheathing exposed to the underside may be of interior type bonded with exterior glue, identified as Exposure 1.

**5803.2.1.2 Fire-retardant-treated Plywood.** The allowable unit stresses for fire-retardant-treated plywood, including fastener values, shall be developed from an approved method of investigation that considers the effects of anticipated temperature and humidity to which the fire-retardant-treated plywood will be subjected, the type of treatment and redrying process. The fire-retardant-treated plywood shall be graded by an approved agency.

**5803.2.2 Allowable Spans.** The maximum allowable spans for wood structural panel roof sheathing shall not exceed the values set forth in 780 CMR Table 5503.2.1.1(1).

**5803.2.3 Installation.** Wood structural panel used as roof sheathing shall be installed with joints staggered or nonstaggered in accordance with 780 CMR Table 5602.3(1), or APA E30 for wood roof framing or with 780 CMR Table 5804.3 for steel roof framing.

**780 CMR 5804 STEEL ROOF FRAMING**

**5804.1 General.** Elements shall be straight and free of any defects that would significantly affect their structural performance. Cold-formed steel roof framing members shall comply with the requirements of 780 CMR 5804.1.

**5804.1.1 Applicability Limits.** The provisions of 780 CMR 5804.1 shall control the construction of steel roof framing for buildings not greater than 60 feet (18 288 mm) in length perpendicular to the joist, rafter or truss span, not greater than 36 feet (10 973 mm) in width parallel to the joist span or truss, not greater than two stories in height with each story not greater than ten feet (3048 mm) high, and roof slopes not smaller than 3:12 (25% slope) or greater than 12:12 (100% slope). Steel roof framing constructed in accordance with the provisions of 780 CMR 5804.1 shall be limited to sites subjected to a maximum design wind speed of 110 miles per hour (209 km/h) Exposure A, B or C and a maximum ground snow load of 70 psf (3.35 kN/m<sup>2</sup>).

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**5804.1.2 In-line Framing.** Steel roof framing constructed in accordance with 780 CMR 5804 shall be located directly in-line with load-bearing studs below with a maximum tolerance of ¾ inch (19.1 mm) between the centerline of the stud and roof joist/rafter.

**5804.2 Structural Framing.** Load-bearing steel roof framing members shall comply with 780 CMR Figure 5804.2(1) and the dimensional and minimum thickness requirements specified in 780 CMR Tables 5804.2(1) and 5804.2(2). Tracks shall comply with 780 CMR Figure 5804.2(2) and shall have a minimum flange width of 1¼ inches (32 mm). The maximum inside bend radius for load-bearing members shall be the greater of 3/32 inch (2.4 mm) or twice the uncoated steel thickness. Holes in roof framing members shall not exceed 1.5 inches (38 mm) in width or four inches (102 mm) in length as shown in 780 CMR Figure 5804.2(3). Holes shall be permitted only along the centerline of the web of the framing member. Holes shall not be less than 24 inches (610 mm) center-to-center and shall not be located less than ten inches (254 mm) from the edge of the hole to the edge of the bearing surface or support unless patched in accordance with 780 CMR 5804.3.6.

**5804.2.1 Material.** Load-bearing steel framing members shall be cold-formed to shape from structural quality sheet steel complying with the requirements of one of the following:

- 1. ASTM A 653; Grades 33, 37, 40 and 50 (Classes 1 and 3).
- 2. ASTM A 792; Grades 33, 37, 40 and 50A.
- 3. ASTM A 875; Grades 33, 37, 40 and 50 (Classes 1 and 3).
- 4. Steels that comply with ASTM A 653, except for tensile and elongation, shall be permitted provided the ratio of tensile strength to yield point is at least 1.08 and the total elongation is at least 10% for a two-inch

**5804.1.3 Roof trusses.** The design, quality assurance, installation and testing of cold-formed steel trusses shall be in accordance with the AISI Standard for Cold-formed Steel Framing-Truss Design (COFS/Truss).

(51 mm) gage length or 7% for an 8-inch (203 mm) gage length.

**5804.2.2 Identification.** Load-bearing steel framing members shall have a legible label, stencil, stamp or embossment with the following information as a minimum:

- 1. Manufacturer’s identification.
- 2. Minimum uncoated steel thickness in inch-es (mm).
- 3. Minimum coating designation.
- 4. Minimum yield strength, in kips per square inch (ksi).

**5804.2.3 Fastening Requirements.** Screws for steel-to-steel connections shall be installed with a minimum edge distance and center-to-center spacing of ½ inch (12.7 mm), shall be self-drilling tapping, and shall conform to SAE J78. Structural sheathing shall be attached to roof rafters with minimum No. 8 self-drilling tapping screws that conform to SAE J78. Screws for attaching structural sheathing to steel roof framing shall have a minimum head diameter of 0.292 inch (7.4mm) with countersunk heads and shall be installed with a minimum edge distance of ¼ inch (9.5 mm). Gypsum board ceilings shall be attached to steel joists with minimum No. 6 screws conforming to ASTM C 954 and shall be installed in accordance with 780 CMR 5805. For all connections, screws shall extend through the steel a minimum of three exposed threads. All self-drilling tapping screws conforming to SAE J78 shall have a minimum Type II coating in accordance with ASTM B 633.

780 CMRTABLE 5804.2(1)  
LOAD-BEARING COLD-FORMED STEEL MEMBER SIZES

| NOMINAL MEMBER SIZE MEMBER DESIGNATION <sup>a</sup> | WEB DEPTH(inches) | MINIMUM FLANGE WIDTH (inches) | MAXIMUM FLANGE WIDTH (inches) | MINIMUM LIP SIZE(inches) |
|---|-------------------|-------------------------------|-------------------------------|--------------------------|
| 350S162-t   | 3.5               | 1.625                         | 2                             | 0.5                      |
| 550S162-t   | 5.5               | 1.625                         | 2                             | 0.5                      |
| 800S162-t   | 8                 | 1.625                         | 2                             | 0.5                      |
| 1000S162-t  | 10                | 1.625                         | 2                             | 0.5                      |
| 1200S162-t  | 12                | 1.625                         | 2                             | 0.5                      |

For SI: 1 inch = 25.4 mm.  
a. The member designation is defined by the first number representing the member depth in 1/100 inch, the letter “s” representing a stud or joist member, the second number representing the flange width in 1/100 inch, and the letter “t” shall be a number representing the minimum base metal thickness in mils [see 780CMR Table 5804.2(2)].

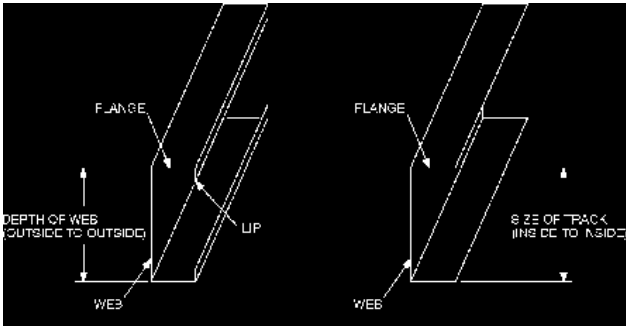
780 CMR TABLE 5804.2(2)

MINIMUM THICKNESS OF COLD-FORMED STEEL ROOF FRAMING MEMBERS

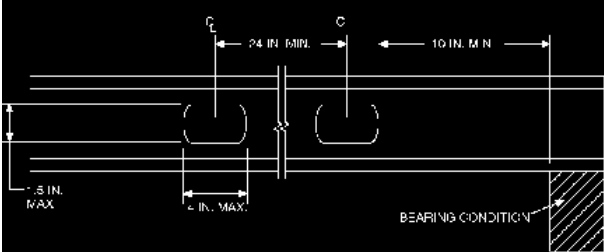
| DESIGNATION (mils) | MINIMUM UNCOATED THICKNESS (inches) | REFERENCED GAGE NUMBER |
|--------------------|-------------------------------------|------------------------|
| 33                 | 0.033                               | 20                     |
| 43                 | 0.043                               | 18                     |
| 54                 | 0.054                               | 16                     |
| 68                 | 0.068                               | 14                     |

For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

780 CMR  
FIGURE 5804.2(1) C-SECTION      FIGURE 5804.2(2) TRACK SECTION



780 CMR FIGURE 5804.2(3)  
WEB HOLES



For SI: 1 inch = 25.4 mm.

Where No. 8 screws are specified in a steel-to-steel connection, the required number of screws in the connection is permitted to be reduced in accordance with the reduction factors in 780 CMR Table 5804.2.3 when larger screws are used or when one of the sheets of steel being connected is thicker than 33 mils (0.84mm). When applying the reduction factor, the resulting number of screws shall be rounded up.

780 CMR TABLE 5804.2.3  
SCREW SUBSTITUTION FACTOR

| SCREW SIZE | THINNEST CONNECTED STEEL SHEET (mils) |      |
|------------|---------------------------------------|------|
|            | 33                                    | 43   |
| #8         | 1                                     | 0.67 |
| #10        | 0.93                                  | 0.62 |
| #12        | 0.86                                  | 0.56 |

For SI: 1 mil = 0.0254 mm.

**5804.3 Roof Construction.** Steel roof systems constructed in accordance with the provisions of 780 CMR 5804.3 shall consist of both ceiling joists and rafters in accordance with 780 CMR

**5804.3.2 Ceiling Joist Bracing.** The bottom flanges of steel ceiling joists shall be laterally braced in accordance with 780 CMR 5702.

Figure 5804.3 and fastened in accordance with 780 CMR Table 5804.3.

**5804.3.1 Allowable Ceiling Joist Spans.** The clear span of cold-formed steel ceiling joists shall not exceed the limits set forth in 780CMR Table 5804.3.1(1) or 5804.3.1(2). Ceiling joists shall have a minimum bearing length of 1.5 inches (38 mm) and shall be connected to rafters (heel joint) in accordance with 780 CMR Figure 5804.3.1(1) and 780CMR Table 5804.3.1(3). When continuous joists are framed across interior bearing supports, the interior bearing supports shall be located within 24 inches (610 mm) of midspan of the ceiling joist, and the individual spans shall not exceed the applicable spans in 780 CMR Table 5804.3.1(1) or 5804.3.1(2). Where required in 780 CMR Table 5804.3.1(1) or 5804.3.1(2), bearing stiffeners shall be installed at each bearing location in accordance with 780 CMR 5804.3.8 and 780 CMR Figure 5804.3.8. When the attic is to be used as an occupied space, the ceiling joists shall be designed in accordance with 780 CMR 5505.

The top flanges of steel ceiling joists shall be laterally braced with a minimum of 33 mil (0.84 mm) C-section, 33 mil (0.84mm) track section,

or 1½ inch by 33 mil (38 mm by 0.84 mm) continuous steel strapping as required in 780 CMR Table 5804.3.1(1) or 5804.3.1(2). Lateral bracing shall be installed in accordance with 780 CMR Figure 5804.3. C-section, tracks or straps shall be fastened to the top flange at each joist with at least one No. 8 screw and shall be fastened to blocking with at least two No. 8 screws. Blocking or bridging (X-bracing) shall be installed between joists in-line with strap bracing at a maximum spacing of 12 feet (3658 mm) measured perpendicular to the joists, and at the termination of all straps. The third point bracing span values from 780 CMR Table 5804.3.1(1) or 5804.3.1(2) shall be used for straps installed at closer spacings than third point bracing, or when

sheathing is applied to the top of the ceiling joists.

**5804.3.3 Allowable Rafter Spans.** The horizontal projection of the rafter span, as shown in 780 CMR Figure 5804.3, shall not exceed the limits set forth in 780 CMR Table 5804.3.3(1). Wind speeds shall be converted to equivalent ground snow loads in accordance with 780 CMR Table 5804.3.3(2). Rafter spans shall be selected based on the higher of the ground snow load or the equivalent snow load converted from the wind speed. When required, a rafter support brace shall be a minimum of 350S162-33 C-section with maximum length of eight feet (2438 mm) and shall be connected to a ceiling joist and rafter with four No. 10 screws at each end.

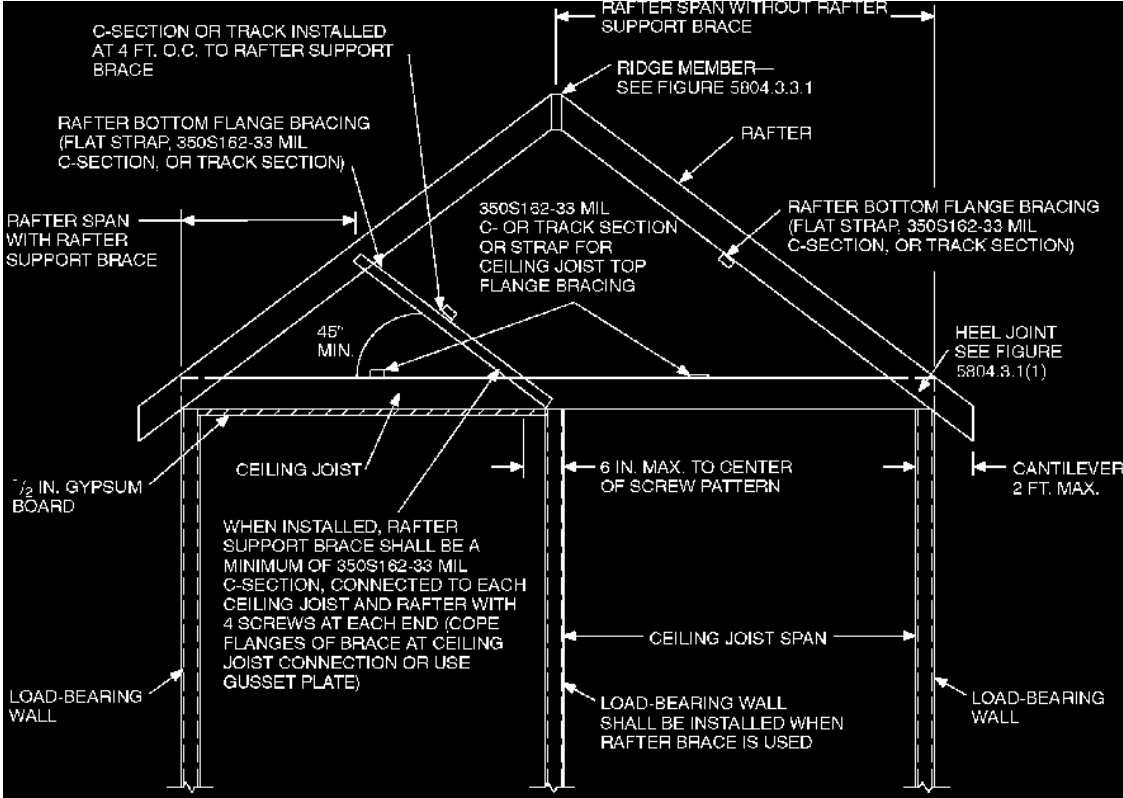
**780 CMR TABLE 5804.3**  
**ROOF FRAMING FASTENING SCHEDULE<sup>a,b</sup>**

| DESCRIPTION OF BUILDING ELEMENTS                            | NUMBER AND SIZE OF FASTENERS                         | SPACING OF FASTENERS   |
|---|--|--|
| Ceiling joist to top track of load-bearing wall             | 2 No. 10 screws                                      | Each joist   |
| Roof sheathing (oriented strand board or plywood) to rafter | No. 8 screws   | 6" o.c. on edges and 12" o.c. at interior supports. 6" o.c. at gable end truss |
| Truss to bearing wall <sup>a</sup>                          | 2 No. 10 screws                                      | Each truss   |
| Gable end truss to endwall top track                        | No. 10 screws  | 12" o.c.   |
| Rafter to ceiling joist                                     | Minimum No. 10 screws, per 780 CMR Table 5804.3.1(3) | Evenly spaced, less than ½" from all edges.                                    |

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m<sup>2</sup>, 1 mil = 0.0254 mm.

- a. Screws shall be applied through the flanges of the truss or ceiling joist or a 54 mil clip angle shall be used with two No.10 screws in each leg. See 780 CMR 5804.4 for additional requirements to resist uplift forces.
- b. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and at all roof plane perimeters. Blocking of roof sheathing panel edges perpendicular to the framing members shall not be required except at the intersection of adjacent roof planes. Roof perimeter shall be supported by framing members or cold-formed blocking of the same depth and gauge as the floor members.

**780 CMR FIGURE 5804.3**  
**STEEL ROOF CONSTRUCTION**



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.



780 CMR TABLE 5804.3.1 (1)  
ALLOWABLE SPANS FOR COLD-FORMED STEEL CEILING JOISTS<sup>a,b,c</sup>  
10 psf live load (no attic storage)

| NOMINAL<br>JOIST SIZE | LATERAL SUPPORT OF TOP (COMPRESSION) FLANGE |                      |                       |                       |                       |                       |
|-----------------------|---|----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                       | Unbraced                                    |                      | Mid-span bracing      |                       | Third-point bracing   |                       |
|                       | Spacing (inches)                            |                      | Spacing (inches)      |                       | Spacing (inches)      |                       |
|                       | 16  | 24                   | 16                    | 24                    | 16                    | 24                    |
| 350S162-33            | 9'-2"                                       | 8'-3"                | 11'-9"                | 10'-1"                | 11'-9"                | 10'-4"                |
| 350S162-43            | 9'-11"                                      | 8'-10"               | 12'-10"               | 11'-2"                | 12'-10"               | 11'-2"                |
| 350S162-54            | 10'-8"                                      | 9'-6"                | 13'-9"                | 12'-0"                | 13'-9"                | 12'-0"                |
| 350S162-68            | 11'-7"                                      | 10'-4"               | 14'-8"                | 12'-10"               | 14'-8"                | 12'-10"               |
| 550S162-33            | 10'-5"                                      | 9'-5"                | 14'-5"                | 12'-8" <sup>nc</sup>  | 16'-4"                | 13'-10" <sup>nc</sup> |
| 550S162-43            | 11'-2"                                      | 10'-1"               | 15'-7"                | 13'-10"               | 18'-0"                | 15'-5"                |
| 550S162-54            | 12'-0"                                      | 10'-9"               | 16'-7"                | 14'-9"                | 19'-5"                | 16'-8"                |
| 550S162-68            | 12'-11"                                     | 11'-7"               | 17'-8"                | 15'-10"               | 20'-11"               | 18'-1"                |
| 800S162-33            | 11'-8" <sup>nc</sup>                        | 10'-6" <sup>nc</sup> | 16'-5" <sup>nc</sup>  | 14'-9" <sup>nc</sup>  | 19'-5" <sup>nc</sup>  | 16'-7" <sup>nc</sup>  |
| 800S162-43            | 12'-6"                                      | 11'-3"               | 17'-6"                | 15'-10"               | 21'-2"                | 18'-7"                |
| 800S162-54            | 13'-4"                                      | 11'-11"              | 18'-7"                | 16'-9"                | 22'-7"                | 20'-0"                |
| 800S162-68            | 14'-3"                                      | 12'-9"               | 19'-8"                | 17'-8"                | 23'-11"               | 21'-4"                |
| 1000S162-43           | 13'-4" <sup>nc</sup>                        | 12'-1" <sup>nc</sup> | 18'-9" <sup>nc</sup>  | 16'-11" <sup>nc</sup> | 22'-11" <sup>nc</sup> | 20'-6" <sup>nc</sup>  |
| 1000S162-54           | 14'-2"                                      | 12'-9"               | 19'-10"               | 17'-10"               | 24'-2"                | 21'-9"                |
| 1000S162-68           | 15'-2"                                      | 13'-7"               | 21'-0"                | 18'-11"               | 25'-6"                | 23'-0"                |
| 1200S162-43           | 14'-1" <sup>nc</sup>                        | 12'-8" <sup>nc</sup> | 19'-10" <sup>nc</sup> | 17'-11" <sup>nc</sup> | 24'-3" <sup>nc</sup>  | 21'-6" <sup>nc</sup>  |
| 1200S162-54           | 15'-0" <sup>nc</sup>                        | 13'-5" <sup>nc</sup> | 20'-11" <sup>nc</sup> | 18'-11" <sup>nc</sup> | 25'-7" <sup>nc</sup>  | 23'-1" <sup>nc</sup>  |
| 1200S162-68           | 15'-11"                                     | 14'-4"               | 22'-2"                | 19'-11"               | 27'-0"                | 24'-4"                |

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m<sup>2</sup>.

- a. Deflection criteria: 1/240 for total loads.
- b. Ceiling dead load = 5 psf.
- c. Bearing stiffeners are required at all bearing points and concentrated load locations.

TABLE 5804.3.1(2)  
ALLOWABLE SPANS FOR COLD-FORMED STEEL CEILING JOISTS<sup>a,b,c</sup>  
20 psf live load (Limited attic storage where development of future rooms is not possible)

| NOMINAL<br>JOIST SIZE | LATERAL SUPPORT OF TOP FLANGE |                      |                      |                       |                       |                      |
|-----------------------|-------------------------------|----------------------|----------------------|-----------------------|-----------------------|----------------------|
|                       | Unbraced                      |                      | Mid-span bracing     |                       | Third-point bracing   |                      |
|                       | Spacing (inches)              |                      | Spacing (inches)     |                       | Spacing (inches)      |                      |
|                       | 16                            | 24                   | 16                   | 24                    | 16                    | 24                   |
| 350S 162-33           | 8'-0"                         | 6'-0"                | 9'-8"                | 6'-0"                 | 9'-0"                 | 6'-0"                |
| 350S162-43            | 8'-8"                         | 7'-8"                | 10'-9"               | 9'-1"                 | 10'-10"               | 9'-5"                |
| 350S162-54            | 9'-3"                         | 8'-3"                | 11'-7"               | 9'-11"                | 11'-7"                | 10'-1"               |
| 350S162-68            | 10'-0"                        | 8'-11"               | 12'-5"               | 10'-10"               | 12'-5"                | 10'-10"              |
| 550S162-33            | 9'-2"                         | 6'-0"                | 12'-2" <sup>nc</sup> | 10'-5" <sup>nc</sup>  | 13'-3"                | 11'-0" <sup>nc</sup> |
| 550S162-43            | 9'-10"                        | 8'-10"               | 13'-4"               | 11'-6"                | 14'-9"                | 12'-5"               |
| 550S162-54            | 10'-5"                        | 9'-5"                | 14'-4"               | 12'-6"                | 16'-1"                | 13'-7"               |
| 550S162-68            | 11'-3"                        | 10'-0"               | 15'-4"               | 13'-5"                | 17'-5"                | 14'-10"              |
| 800S162-33            | 10'-3" <sup>nc</sup>          | 9'-3" <sup>nc</sup>  | 14'-4" <sup>nc</sup> | 12'-5" <sup>nc</sup>  | 15'-11" <sup>nc</sup> | 13'-4" <sup>nc</sup> |
| 800S162-43            | 10'-11"                       | 9'-10"               | 15'-5"               | 13'-8" <sup>nc</sup>  | 17'-11" <sup>nc</sup> | 15'-5" <sup>nc</sup> |
| 800S162-54            | 11'-8"                        | 10'-6"               | 16'-3"               | 14'-7"                | 19'-3"                | 16'-8"               |
| 800S162-68            | 12'-5"                        | 11'-2"               | 17'-3"               | 15'-6"                | 20'-7"                | 18'-0"               |
| 1000S162-43           | 11'-9"                        | 10'-7" <sup>nc</sup> | 16'-6" <sup>nc</sup> | 14'-10" <sup>nc</sup> | 19'-10" <sup>nc</sup> | 17'-1" <sup>nc</sup> |
| 1000S162-54           | 12'-5"                        | 11'-2"               | 17'-5"               | 15'-8"                | 21'-1"                | 18'-7"               |
| 1000S162-68           | 13'-3"                        | 11'-10"              | 18'-5"               | 16'-7"                | 22'-4"                | 19'-11"              |
| 1200S162-43           | 12'-5" <sup>nc</sup>          | 11'-2" <sup>nc</sup> | 17'-5" <sup>nc</sup> | 15'-8" <sup>nc</sup>  | 20'-9" <sup>nc</sup>  | 18'-0" <sup>nc</sup> |
| 1200S162-54           | 13'-1" <sup>nc</sup>          | 11'-9" <sup>nc</sup> | 18'-5" <sup>nc</sup> | 16'-7" <sup>nc</sup>  | 22'-5" <sup>nc</sup>  | 20'-1" <sup>nc</sup> |
| 1200S162-68           | 13'-11"                       | 12'-6"               | 19'-5"               | 17'-6"                | 23'-8"                | 21'-3"               |

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m<sup>2</sup>.

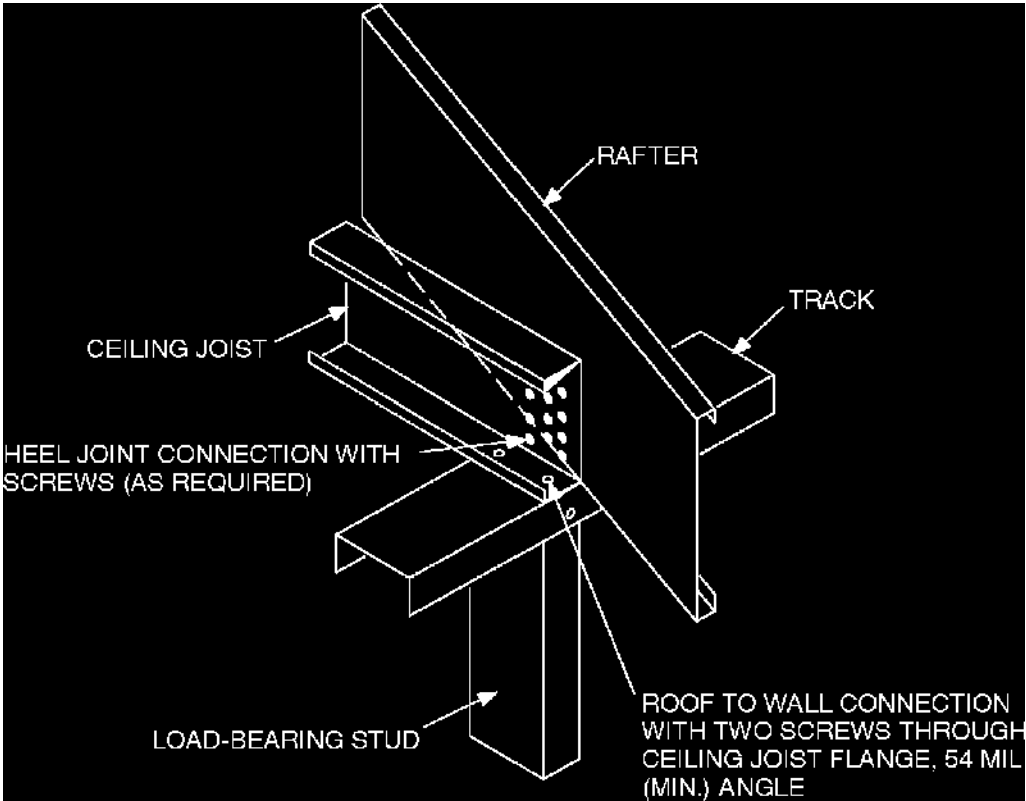
- a. Deflection criteria: 1/240 for total loads.
- b. Ceiling dead load = 5 psf.
- c. Bearing stiffeners are required at all bearing points and concentrated load locations.

780 CMR TABLE 5804.3.1(3)  
NUMBER OF SCREWS REQUIRED FOR CEILING JOIST TO RAFTER CONNECTION<sup>a</sup>

| ROOF<br>SLOPE | BUILDING WIDTH (feet)     |    |    |    |                           |    |    |    |                           |    |    |    |                           |    |    |    |
|---------------|---------------------------|----|----|----|---------------------------|----|----|----|---------------------------|----|----|----|---------------------------|----|----|----|
|               | 24                        |    |    |    | 28                        |    |    |    | 32                        |    |    |    | 36                        |    |    |    |
|               | Ground snow load<br>(psf) |    |    |    | Ground snow load<br>(psf) |    |    |    | Ground snow load<br>(psf) |    |    |    | Ground snow load<br>(psf) |    |    |    |
|               | 20                        | 30 | 50 | 70 | 20                        | 30 | 50 | 70 | 20                        | 30 | 50 | 70 | 20                        | 30 | 50 | 70 |
| 3:12          | 5                         | 6  | 9  | 12 | 6                         | 7  | 10 | 13 | 7                         | 8  | 12 | 15 | 8                         | 9  | 13 | 17 |
| 4:12          | 4                         | 5  | 7  | 9  | 5                         | 6  | 8  | 10 | 6                         | 6  | 9  | 12 | 6                         | 7  | 10 | 13 |
| 5:12          | 4                         | 4  | 6  | 7  | 4                         | 5  | 7  | 9  | 5                         | 5  | 8  | 10 | 5                         | 6  | 9  | 11 |
| 6:12          | 3                         | 4  | 5  | 7  | 4                         | 4  | 6  | 8  | 4                         | 5  | 7  | 9  | 4                         | 5  | 7  | 10 |
| 7:12          | 3                         | 3  | 5  | 6  | 3                         | 4  | 5  | 7  | 4                         | 4  | 6  | 8  | 4                         | 5  | 7  | 9  |
| 8:12          | 3                         | 3  | 4  | 5  | 3                         | 3  | 5  | 6  | 3                         | 4  | 5  | 7  | 4                         | 4  | 6  | 8  |
| 9:12          | 2                         | 3  | 4  | 5  | 3                         | 3  | 4  | 6  | 3                         | 4  | 5  | 6  | 3                         | 4  | 6  | 7  |
| 10:12         | 2                         | 3  | 4  | 5  | 3                         | 3  | 4  | 5  | 3                         | 3  | 5  | 6  | 3                         | 4  | 5  | 7  |
| 11:12         | 2                         | 3  | 4  | 4  | 3                         | 3  | 4  | 5  | 3                         | 3  | 5  | 6  | 3                         | 4  | 5  | 6  |
| 12:12         | 2                         | 3  | 3  | 4  | 2                         | 3  | 4  | 5  | 3                         | 3  | 4  | 6  | 3                         | 4  | 5  | 6  |

For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m<sup>2</sup>.  
a. Screws shall be No. 10 minimum.

780 CMR FIGURE 5804.3.1(1)  
JOIST TO RAFTER CONNECTION



For SI: 1 mil = 0.0254 mm.

780 CMR TABLE 5804.3.3(1)  
ALLOWABLE HORIZONTAL RAFTER SPANS<sup>a,b</sup>

| NOMINAL<br>RAFTER SIZE | GROUND SNOW LOAD      |         |                       |        |                       |        |                       |         |
|------------------------|-----------------------|---------|-----------------------|--------|-----------------------|--------|-----------------------|---------|
|                        | 20 psf                |         | 30 psf                |        | 50 psf                |        | 70 psf                |         |
|                        | Spacing (inches-feet) |         | Spacing (inches-feet) |        | Spacing (inches-feet) |        | Spacing (inches-feet) |         |
|                        | 16                    | 24      | 16                    | 24     | 16                    | 24     | 16                    | 24      |
| 550S162-33             | 12'-8"                | 10'-4"  | 11'-9"                | 9'-7"  | 9'-11"                | 8'-1"  | 8'-10"                | 7'-2"   |
| 550S162-43             | 15'-5"                | 12'-7"  | 14'-3"                | 11'-8" | 12'-1"                | 9'-10" | 10'-8"                | 8'-9"   |
| 550S162-54             | 13'-0"                | 14'-2"  | 16'-1"                | 13'-1" | 13'-8"                | 11'-2" | 12'-1"                | 9'-10"  |
| 550S162-68             | 18'-1"                | 15'-10" | 17'-3"                | 14'-9" | 15'-4"                | 12'-6" | 13'-6"                | 11'-1"  |
| 800S162-33             | 15'-5"                | 11'-5"  | 14'-4"                | 9'-10" | 10'-7"                | 7'-1"  | 8'-3"                 | 5'-6"   |
| 800S162-43             | 19'-1"                | 15'-7"  | 17'-9"                | 14'-6" | 15'-1"                | 12'-3" | 13'-3"                | 10'-9"  |
| 800S162-54             | 22'-7"                | 18'-5"  | 21'-0"                | 17'-1" | 17'-9"                | 14'-6" | 15'-9"                | 12'-10" |
| 800S162-68             | 24'-7"                | 20'-9"  | 23'-4"                | 19'-3" | 20'-0"                | 16'-4" | 17'-8"                | 14'-5"  |
| 1000S162-43            | 21'-2"                | 17'-3"  | 19'-8"                | 16'-0" | 16'-8"                | 13'-1" | 14'-9"                | 10'-3"  |
| 1000S162-54            | 25'-1"                | 20'-6"  | 23'-3"                | 19'-0" | 19'-9"                | 16'-1" | 17'-5"                | 14'-3"  |
| 1000S162-68            | 29'-6"                | 24'-6"  | 27'-9"                | 22'-9" | 23'-8"                | 19'-3" | 21'-0"                | 17'-1"  |
| 1200S162-43            | 23'-0"                | 18'-2"  | 21'-4"                | 15'-7" | 16'-9"                | 11'-3" | 13'-2"                | 8'-9"   |
| 1200S162-54            | 27'-3"                | 22'-3"  | 25'-3"                | 20'-7" | 21'-5"                | 17'-6" | 18'-11"               | 15'-5"  |
| 1200S162-68            | 32'-1"                | 26'-2"  | 29'-9"                | 24'-3" | 25'-3"                | 20'-7" | 22'-4"                | 18'-2"  |

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m<sup>2</sup>.

a. Deflection criteria: 1/240 for live loads and 1/180 for total loads.

b. Roof dead load = 12 pounds per square foot.

780 CMR TABLE 5804.3.3(2)  
BASIC WIND SPEED TO EQUIVALENT SNOW LOAD CONVERSION

| BASIC WIND<br>SPEED AND<br>EXPOSURE |         | EQUIVALENT GROUND SNOW LOAD (psf) |      |      |      |      |      |      |       |       |       |
|-------------------------------------|---------|-----------------------------------|------|------|------|------|------|------|-------|-------|-------|
|                                     |         | Roof slope                        |      |      |      |      |      |      |       |       |       |
|                                     |         | 3:12                              | 4:12 | 5:12 | 6:12 | 7:12 | 8:12 | 9:12 | 10:12 | 11:12 | 12:12 |
| Exp. A/B                            | Exp. C  |                                   |      |      |      |      |      |      |       |       |       |
| 85 mph                              | —       | 20                                | 20   | 20   | 20   | 20   | 20   | 30   | 30    | 30    | 30    |
| 100 mph                             | 85 mph  | 20                                | 20   | 20   | 20   | 30   | 30   | 30   | 30    | 50    | 50    |
| 110 mph                             | 100 mph | 20                                | 20   | 20   | 20   | 30   | 50   | 50   | 50    | 50    | 50    |
| —                                   | 110 mph | 30                                | 30   | 30   | 50   | 50   | 50   | 70   | 70    | 70    | —     |

For SI: 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kN/m<sup>2</sup>.

**5804.3.3.1 Rafter Framing.** Rafters shall be connected to a parallel ceiling joist to form a continuous tie between exterior walls in accordance with 780 CMR Figures 5804.3 and 5804.3.1(1) and 780 CMR Table 5804.3.1(3). Rafters shall be connected to a ridge member with a minimum two-inch by two-inch (51 mm by 51 mm) clip angle fastened with minimum No. 10 screws to the ridge member in accordance with 780 CMR Figure 5804.3.3.1 and 780 CMR Table 5804.3.3.1. The clip angle shall have a minimum steel thickness as the rafter member and shall extend the full depth of the rafter member. The ridge member shall be fabricated from a C-section and a track section, which shall be of a minimum size and steel thickness as the adjacent rafters and shall be installed in accordance with 780 CMR Figure 5804.3.3.1.

**5804.3.3.2 Roof Cantilevers.** Roof cantilevers shall not exceed 24 inches (610 mm) in accordance with 780 CMR Figure 5804.3. Roof cantilevers shall be supported

by a header in accordance with 780 CMR 5603.6 or shall be supported by the floor framing in accordance with 780 CMR 5505.3.7.

**5804.3.4 Rafter Bottom Flange Bracing.** The bottom flanges of steel rafters shall be continuously braced with a minimum 33-mil (0.84 mm) C-section, 33-mil (0.84 mm) track section, or a 1½-inch by 33-mil (38 mm by 0.84mm) steel strapping at a maximum spacing of eight feet (2438 mm) as measured parallel to the rafters. Bracing shall be installed in accordance with 780 CMR Figure 5804.3. The C-section, track section, or straps shall be fastened to blocking with at least two No. 8 screws. Blocking or bridging (X-bracing) shall be installed between rafters in-line with the continuous bracing at a maximum spacing of 12 feet (3658 mm) measured perpendicular to the rafters and at the termination of all straps. The ends of continuous bracing shall be fastened to blocking with at least two No. 8 screws.

THE MASSACHUSETTS STATE BUILDING CODE

**5804.3.5 Cutting and Notching.** Flanges and lips of load-bearing steel roof framing members

**5804.3.6 Hole Patching.** Holes in ceiling joist and rafters with dimensions conforming to 780 CMR 5804.2 that are closer than ten inches (254 mm) from the edge of the hole to the edge of bearing surface shall be patched with a solid steel plate, C-section or track section in accordance with 780 CMR Figure 5804.3.6. The steel patch shall be of a minimum thickness as the receiving member and shall extend at least one inch (25.4 mm) beyond all edges of the hole. The steel patch shall be fastened to the web with No. 8 screws (minimum) spaced no greater than one inch (25.4 mm) center-to-center along the edges of the patch, with a minimum edge distance of ½ inch (12.7 mm).

**5804.3.7 Splicing.** Rafters and other structural members, except ceiling joists, shall not be spliced. Splices in ceiling joists shall only be permitted at interior bearing points and shall be constructed in accordance with 780 CMR Figure 5804.3.7(1). Spliced ceiling joists shall be connected with the same number and size of screws on connection. Splicing of tracks shall conform with 780 CMR Figure 5804.3.7(2).

**5804.3.8 Bearing Stiffener.** A bearing stiffener shall be fabricated from a minimum 33-mil (0.84 mm) C-section or track section. Each stiffener shall be fastened to the web of the ceiling joist with a minimum of four No. 8 screws equally spaced as shown in 780 CMR Figure 5804.3.8. Stiffeners shall extend across

shall not be cut or notched. Holes in webs shall be in accordance with 780 CMR 5804.2.

the full depth of the web and shall be installed on either side of the web.

**5804.3.9 Headers.** Roof-ceiling framing above wall openings shall be supported on headers. The allowable spans for headers in bearing walls shall not exceed the values set forth in 780 CMR Table 5603.6(1).

**5804.3.10 Framing of Opening.** Openings in roof and ceiling framing shall be framed with headers and trimmers between ceiling joists or rafters. Header joist spans shall not exceed four feet (1219 mm). Header and trimmer joists shall be fabricated from joist and track sections, which shall be of a minimum size and thickness in accordance with 780 CMR Figures 5804.3.10(1) and 5804.3.10(2). Each header joist shall be connected to trimmer joist with a minimum of four two-inch by two-inch (51mm by 51 mm) clip angles. Each clip angle shall be fastened to both the header and trimmer joists with four No. 8 screws, evenly spaced, through each leg of the clip angle. The clip angles shall have a steel thickness not less than that of the floor joist.

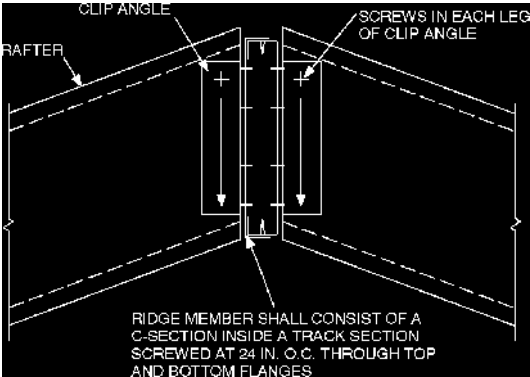
**5804.4 Roof Tie-down.** Roof assemblies subject to wind uplift pressures of 20 pounds per square foot (0.96 kN/m<sup>2</sup>) or greater, as established in 780 CMR Table 5301.2(2), shall have rafter-to-bearing wall ties provided in accordance with 780 CMR Table 5802.11.

780 CMR TABLE 5804.3.3.1  
NUMBER OF SCREWS REQUIRED AT EACH LEG OF CLIP ANGLE FOR RAFTER  
TO RIDGE MEMBER CONNECTION<sup>a</sup>

| BUILDING WIDTH<br>(feet) | GROUND SNOW LOAD (psf) |          |          |          |
|--------------------------|------------------------|----------|----------|----------|
|                          | 0 to 20                | 21 to 30 | 31 to 50 | 51 to 70 |
| 24                       | 2                      | 3        | 4        | 4        |
| 28                       | 2                      | 3        | 4        | 5        |
| 32                       | 3                      | 3        | 4        | 5        |
| 36                       | 3                      | 4        | 5        | 6        |

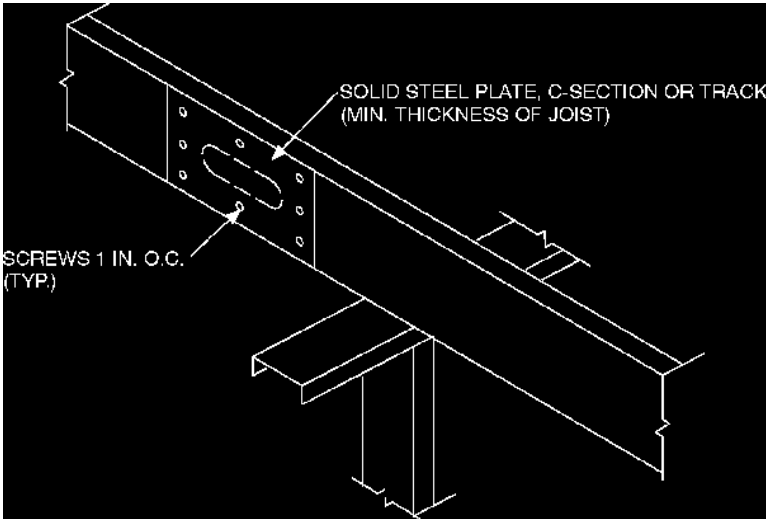
For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kN/m<sup>2</sup>.  
a. Screws shall be No. 10 minimum.

780 CMR FIGURE 5804.3.3.1  
RIDGE BOARD CONNECTION



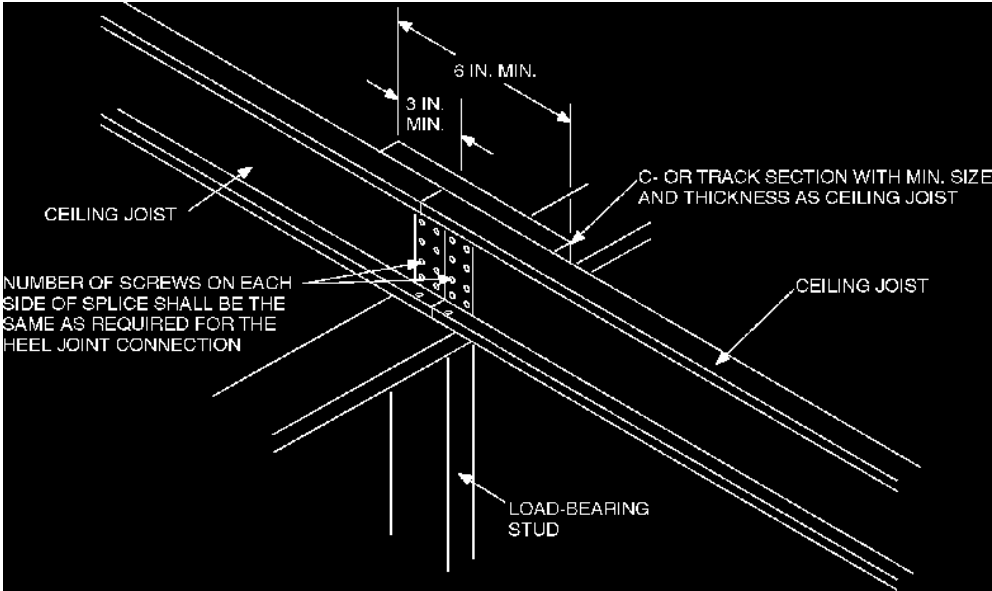
For SI: 1 inch = 25.4 mm.

780 CMR FIGURE 5804.3.6  
HOLE PATCHING



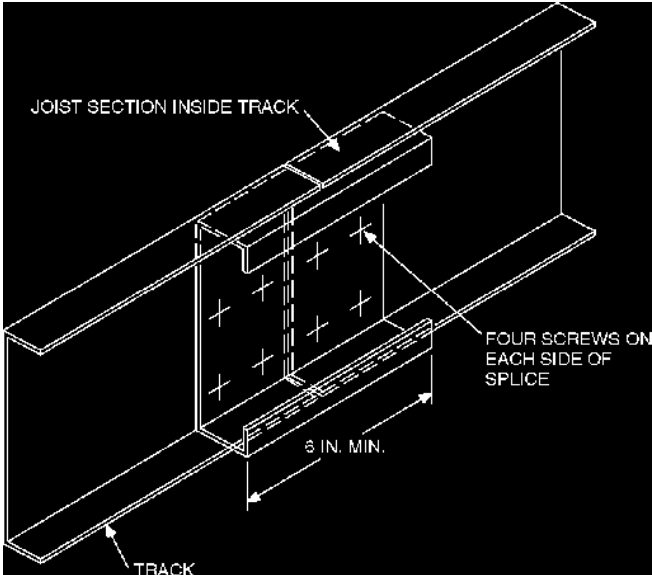
For SI: 1 inch = 25.4 mm.

FIGURE 5804.3.7(1)  
SPliced CEILING JOISTS



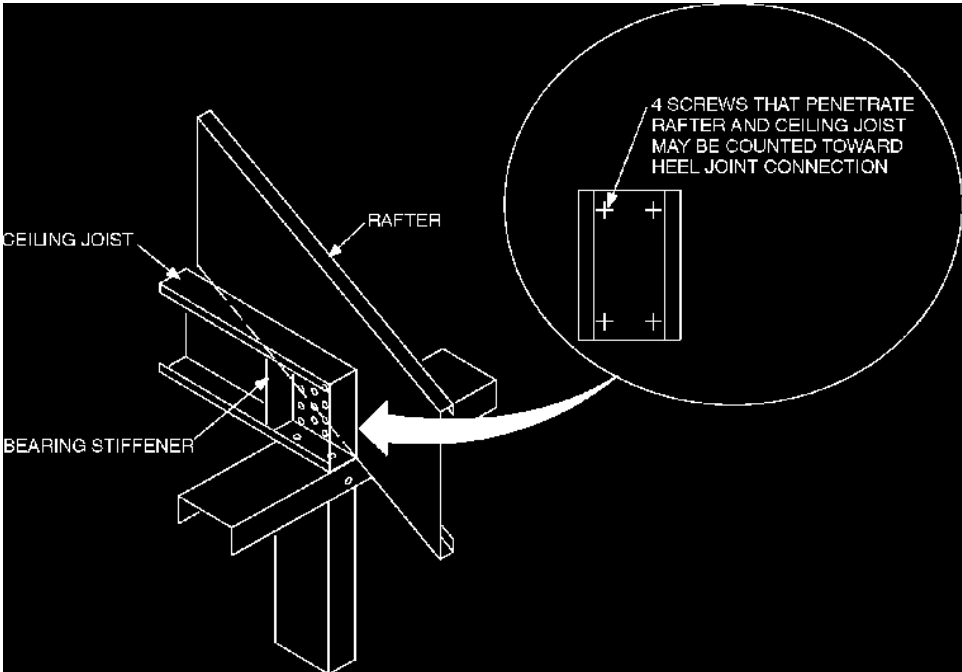
For SI: 1 inch = 25.4 mm.

780 CMR FIGURE 5804.3.7(2)  
TRACK SPLICE

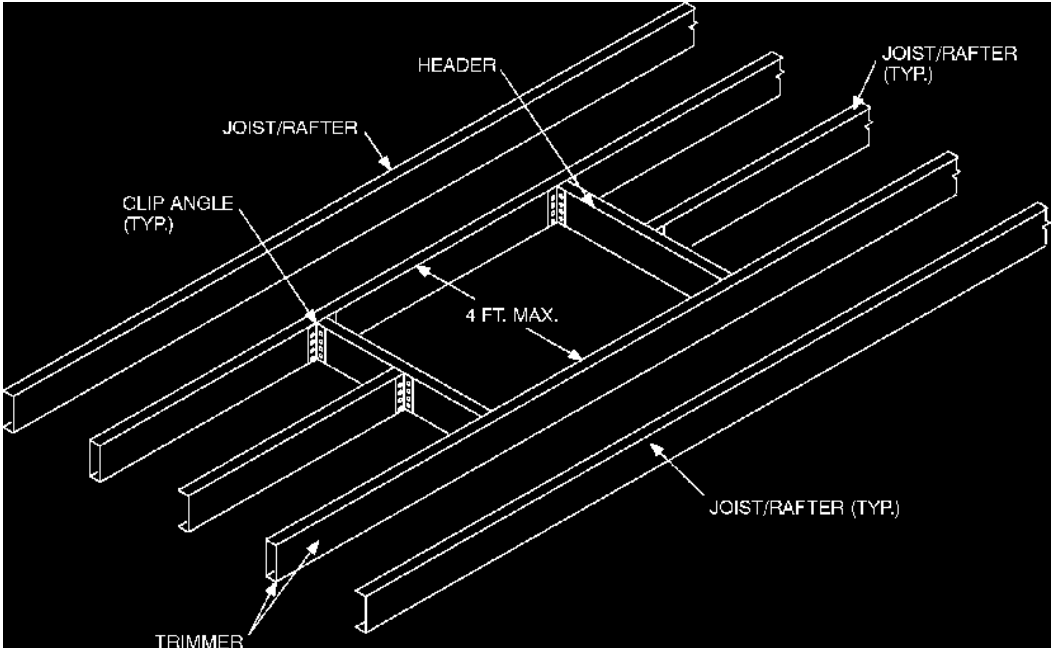


For SI: 1 inch = 25.4 mm.

780 CMR FIGURE 5804.3.8  
BEARING STIFFENER

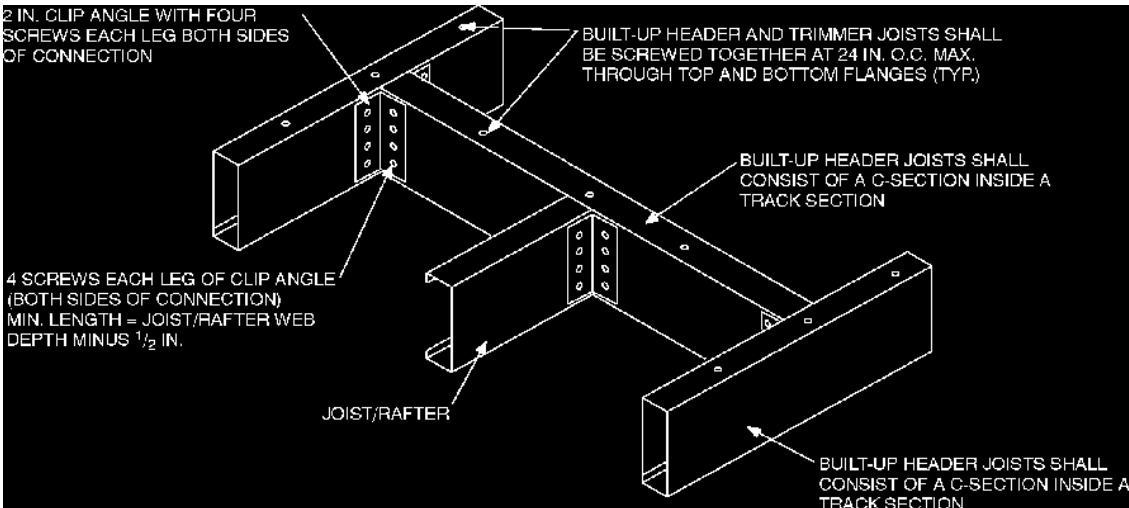


780 CMR FIGURE 5804.3.10(1)  
ROOF OPENING



For SI: 1 foot = 304.8 mm.

780 CMR FIGURE 5804.3.10(2)  
HEADER TO TRIMMER CONNECTION



For SI: 1 inch = 25.4 mm.



**780 CMR 5805 CEILING FINISHES**

**5805.1 Ceiling installation.** Ceilings shall be installed in accordance with the requirements for interior wall finishes as provided in 780 CMR 5702.

**780 CMR 5806 ROOF VENTILATION**

**5806.1 Ventilation Required.** Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain or snow. Ventilating openings shall be provided with corrosion-resistant wire mesh, with  $\frac{1}{8}$  inch (3.2 mm) minimum to  $\frac{1}{4}$  inch (6.4 mm) maximum openings.

**Exceptions:**

- 1. Roof assemblies where an expanding spray foam insulation material, providing at least 40% of the total R-value of the required insulation, is in direct contact with the underside of the roof deck and adjacent framing members. If the permeability of the foam material is less than two perm-inch, no vapor barrier is necessary.*
- 2. Roof assemblies where a board foam plastic insulation material, providing at least 40% of the total R-value of the required insulation, is placed on top of the roof deck. If the permeability of the foam material is less than two perm-inch, no vapor barrier is necessary.*

*When either of the above exceptions is taken, the following conditions must also be satisfied:*

- 1. The roof assembly, including the wall-to-eave-to-roof-deck connection must be made air tight, per 780 CMR J4.3.3 or 780 CMR 1304.3, as possible.*
- 2. Thermal barrier requirements, if any, shall be per 780 CMR 2603.4, as applicable.*
- 3. The roof assembly must meet the fire-resistance-rating requirements of 780 CMR, when and as applicable.*
- 4. Roofing material must be listed/warranted by its manufacturer for use in an unvented roof system.*

**5806.2 Minimum Area.** The total net free ventilating area shall not be less than one to 150 of the area of the space ventilated except that the total area is permitted to be reduced to one to 300,

provided at least 50% and not more than 80% of the required ventilating area is provided by ventilators located in the upper portion of the space to be ventilated at least three feet (914 mm) above eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents. As an alternative, the net free cross-ventilation area may be reduced to one to 300 when a vapor barrier having a transmission rate not exceeding one perm ( $57.4 \text{ mg/s} \cdot \text{m}^2 \cdot \text{Pa}$ ) is installed on the warm side of the ceiling.

**5806.3 Vent Clearance.** Where eave or cornice vents are installed, insulation shall not block the free flow of air. A minimum of a one-inch (25.4 mm) space shall be provided between the insulation and the roof sheathing at the location of the vent.

**780 CMR 5807 ATTIC ACCESS**

**5807.1 Attic Access.** An attic access opening shall be provided to attic areas that exceed 30 square feet ( $2.8 \text{ m}^2$ ) and have a vertical height of 30 inches (762 mm) or greater.

The rough-framed opening shall not be less than 22 inches by 30 inches (559 mm by 762 mm) and shall be located in a hallway or other readily accessible location. A 30-inch (762 mm) minimum unobstructed headroom in the attic space shall be provided at some point above the access opening. See 780 CMR 6305.1.3 for access requirements where mechanical equipment is located in attics.

*All attic access doors, trap doors, etc., separating conditioned from unconditioned space shall be fitted with suitable gaskets, weather strips, etc., and fit and close tightly to ensure minimal air leakage between conditioned and unconditioned space (also see 780 CMR 61.00).*

**780 CMR 5808 INSULATION CLEARANCE**

**5808.1 Combustible Insulation.** Combustible insulation shall be separated a minimum of three inches (76 mm) from recessed lighting fixtures, fan motors and other heat-producing devices.

**Exception:** When heat-producing devices are listed for lesser clearances, combustible insulation complying with the listing requirements shall be separated in accordance with the conditions stipulated in the listing.

Recessed lighting fixtures installed in the building thermal envelope shall meet the requirements of **780 CMR 61.00**.